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TEXAS A&M UNIVERSITY

ShipLAB Research Portfolio 2013

Filipe Castro
Department of Anthropology
Nautical Archaeology Program
Center for Maritime Archaeology and Conservation

ShipLAB

2013 Research Portfolio

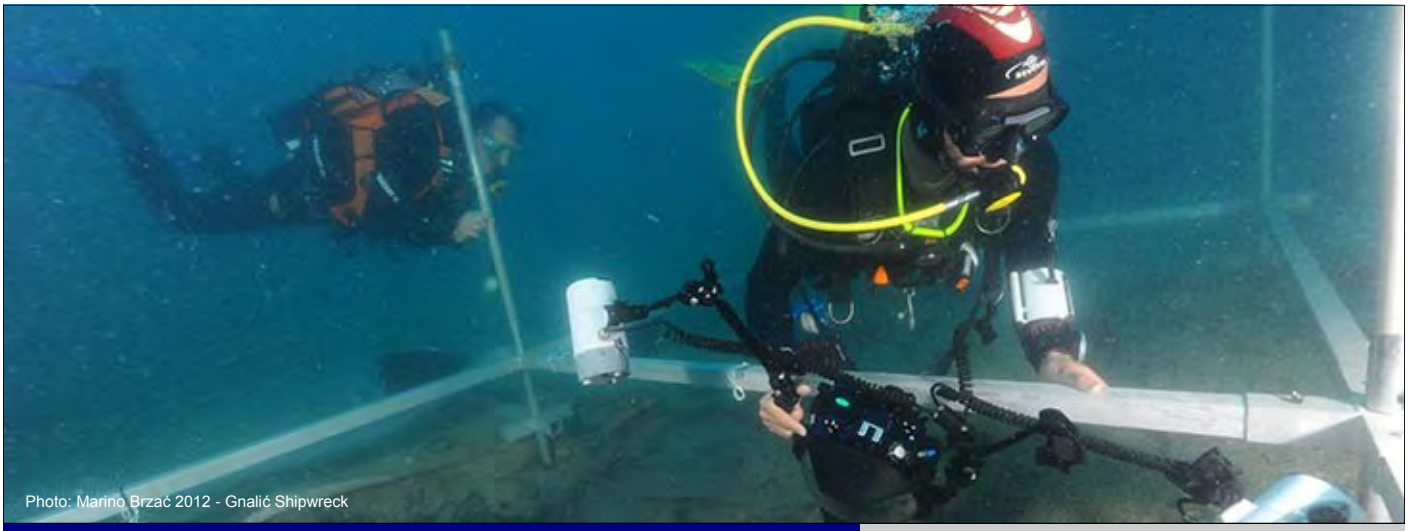


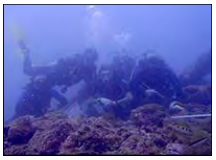
Photo: Marino Brzać 2012 - Gnalić Shipwreck

ShipLAB Mission

The ShipLab was created by J. Richard Steffy in 1976 and today is one of the laboratories of the Centre for Maritime Archaeology and Conservation of the Anthropology Department at Texas A&M University. Our mission is to acquire and disseminate knowledge about shipbuilding through time. As a classroom iour main objective is to provide an effective learning environment. As a research laboratory our objective is to facilitate investigation, seek public and private research funds, and recruit and retain quality students for our projects. As an outreach institution we aim at providing information, education, and guidance on the discipline of nautical archaeology and the importance of the world's submerged cultural heritage, perhaps more than ever threatened by treasure hunting.

Gnalić Project, dir. Irena Radic Rossi, started in 2011, the excavation of a large merchantmen lost off the Croatian coast in 1583 with a large cargo bound for Constantinople.

Stella 1 Shipwreck, dir. Massimo Capulli, started in 2011, is part of a wider study of the life along the Stella River, Italy, over a period of two millennia.



Battle of Itaparica, dir. Rodrigo Torres, studies the 1648 battle of Itaparica and its Portuguese and Dutch Shipwrecks.

Finisterre Project, dir. Miguel San Claudio and José Luis Casaban, is a study and inventory of shipwrecks along in Galician waters.

Ship Modeling

With Nuno Fonseca from **IST's SAEN**, and **Texas A&M VizLAB**, we are developing methods to compare hull shapes, performances and capacities.

NADL

With Richard Furura, director of the **Texas A&M Center for the Study of Digital Libraries**, we are using computers and computer science to develop a better understanding of what in means to be an archaeologist in the digital era.

Vasa

Using 3D computer software, Kelby Rose is studying and reconstructing the hull of the warship *Vasa*, lost in 1628 on its first voyage.

Saveiros da Bahia

With Denise Gomes Dias, from University of the State of Bahia (UNEB), we are recording whole molding techniques that survived for centuries in the Baía de Todos os Santos region, in Brazil.

J. Richard Steffy Ship Reconstruction Laboratory
Director: FILIPE VIEIRA DE CASTRO | PROFESSOR
Frederic R. Mayer Fellow II of Nautical Archaeology
105 Anthropology Building, Texas A&M University, TX 77843-4352 - fvcastro@tamu.edu

Featured Projects

Submerged Cultural Heritage: a Future for the Past

- **Rodrigo Torres** (PhD) Stranded Shipwrecks of Southern Brazil.
- **Samila Ferreira** (PhD) Policies of Memory, Politics of Forgetting. São Lourenço do Sul, Brazil.
- **Samuel Cuellar** (PhD) A History of Ship Bells.
- The Gnalić Project, Croatia.
- Stella 1 Shipwreck, Italy.
- The Nautical Archaeology of Puerto Rico.
- Lagos Project, Portugal.
- Oeiras Guns, Portugal.

Ship Modeling and Visualization Sciences

- The Textual Excavation of a India Nau.
- Sailing the Pepper Wreck.
- Modeling the Pepper Wreck.
- A Parametric Model of the India Naus.
- **Kelby Rose** (PhD) A Tridimensional Study of *Vasa*.
- **José Casaban** (PhD) *Nuestra Señora del Juncal*, México
- **Kotaro Yamafune** (PhD) A Reconstruction of the Pepper Wreck .

Computer Science

- The Nautical Archaeology Digital Library
- Photogrammetry and Timber Recording

Iberian Seafaring

- Astrolabes Database
- Iberian Ships Database
- Pepper Wreck Project, Portugal.
- Arade 1 Project, Portugal.
- Cais do Sodré Project, Portugal.
- Cape Finisterre Project, Spain.
- **Nicholas Budsberg** (PhD) Ships of Discovery and the Renaissance.
- Saveiros da Baía, Brazil.
- Battle of Itaparica, Brazil.
- Playa Damas Shipwreck, Panama.

Italian Seafaring

Asian Seafaring

- **Randal Sasaki** (PhD) Bach Tang Excavation, Vietnam
- Kublai Khan and the 1279 Attempted Invasion of Japan
- Namban Screens and the Portuguese in Japan
- Ancient Ships of Japan

Current Students

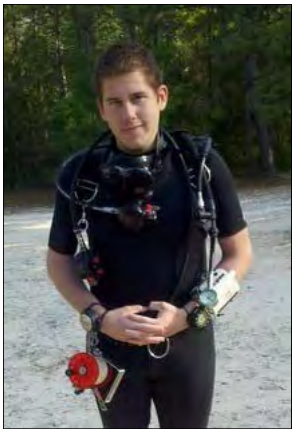
Eight students are currently working towards their PhD in the ShipLAB, doing their dissertation research while they prepare themselves to become competent scholars and dedicated professionals with practical skills that will allow them to compete for the best jobs on the market.

Nicholas Budsberg

Nicholas Budsberg is a doctoral student in the Nautical Archaeology Program where he is studying the maritime impacts of the European expansion. His research focuses on the Spanish and Portuguese vessels that first charted and explored the African coast and the New World, and that would later be the first to circumnavigate the globe. Nicholas's current focus is the re-investigation of possibly the earliest European shipwreck site in the New World located off of the coast of Highbourne Cay in the Exumas, Bahamas. In addition, he is currently finishing the conservation and analyses of a 17th century Portuguese Astrolabe, after this rare example of the instrument was brought to the attention of the Conservation Research Lab at Texas A&M. Nicholas received his Bachelor of Arts in Anthropology with an Archaeology Concentration from Western Washington University in 2010. His field work and experience has been mostly accumulated in the Balearic Islands, Spain, and in the Aucilla River, Florida, while during the academic year he is an officer with the Archaeology Dive Club, and the Nautical Archaeology Student Association. He is an L.T. Jordan International Fellow, holds a Graduate Assistant - Teaching position, and is the recipient of several other internal and external grants and scholarships. He is currently finishing his coursework in College Station, Texas, while he will be working with the Bahamian government on shipwreck, conservation and cultural heritage projects.

José Luis Casaban

José Luis Casaban completed his B.A in Prehistory and Archaeology at the University of Valencia (Spain) in 1998 and his M.A. in Post-Excavation Skills (GIS applications in Archaeology) at the School of Archaeology and Ancient History at the University of Leicester (UK) in 2000. Since then Jose has worked as a field archaeologist for different CRM firms in Spain and Ireland. He worked as an archaeological surveyor in Ireland for 2 years, and has directed several archaeological projects, both on land and underwater, in Spain. In addition, he was also part of the archaeological team (as an archaeologist and photogrammetry technician) working on INA's Bajo de la Campana Phoenician Wreck project in Spain (2008-2010). Always interested in underwater archaeology, Jose started his PhD in Nautical Archaeology at Texas A&M in 2010. Since then he has taken part in the Mazotos project, a 4th century BC shipwreck located off the coast in Cyprus. Jose is currently one the project directors of the INA Finisterre Project in Spain. This project is focused on the study of 16th and 17th Iberian seafaring shipbuilding technology, which encompasses his main doctoral research interest.



Samuel Cuellar

Sam Cuellar completed his BA in Anthropology at Texas A&M University in Spring of 2011 and began his graduate studies at Texas A&M's Nautical Archaeology Program (NAP)in Fall of 2011. Sam's dissertation work focuses on the first study undertaken of the origins, history, and uses of early ship bells dating up until the beginning of the 18th century. Fieldwork for his dissertation will take place in Europe over the Summer of 2014, and involve the examination of numerous ship's bells in private collections and museums, as well as additional archival research. Sam's current fieldwork includes assisting in the excavation of the Gnalic shipwreck off the coast of Croatia. During his graduate career, Sam has developed interest in the relationship between underwater archaeologists and offshore oil and gas drilling in the Gulf of Mexico through work with Texas Nautical Archaeologist Amy Borgens. He plans to develop ways to enhance the relationship between the academic and business sides of underwater archaeology to increase information sharing and cooperation.

Samila Ferreira

Samila Ferreira is a Doctorate Student at the Cultural Anthropology Program. She graduated with a B.A. in History from the Federal University of Rio Grande, Brazil in 2008, and with a M.A. in Social Memory and Cultural Heritage from The Federal University of Pelotas, Brazil in 2010. Her Master's thesis discusses concepts of cultural heritage, social memory, public policy, and the invention of traditions. During her career she has been focusing her research efforts primarily on studying the relation between social memories, cultural heritage and the effects of public policies on the representation/oblivion of social groups in heritage preservation projects. Her empirical work has been carried out in the historical port town of São Lourenço do Sul, southern Brazil. Her doctoral research proposal will undertake a comparative study of this theme in Brazil and in the US.

Kelby Rose

Reverse Naval Architecture of Vasa*, a 17th-Century Swedish Warship*

Kelby Rose is a PhD candidate in the Nautical Archaeology Program. While in the program, Kelby has served as a member on underwater archaeological expeditions in Turkey and Italy, a conservation technician at the Center for Maritime Archaeology and Conservation Research Laboratory, and as graduate instructor of record for two undergraduate anthropology courses. His dissertation research is a pioneering investigation into the naval architecture of the Swedish warship *Vasa*, sunk on its maiden voyage in 1628. During his graduate career, Kelby has developed a particular interest in the archaeological and educational application of visualization technologies. Using advanced digital 3D modeling software, he is virtually deconstructing the hull of *Vasa* to recover and analyze the methods used to design the ship. Kelby believes strongly in the power of existing and emerging technologies to bridge the gap between the important work of nautical archaeologists and the interested public.

http://www.kelbyrose.com/

Randall Sasaki

Randall J. Sasaki was born and raised in Japan, but moved to U.S. to complete his B.A. in Anthropology (specializing in Indian Ocean Seafaring in the Bronze Age) at Southwest Missouri State University (currently Missouri State University). After working as a field supervisor at several CRM companies, he decided to pursue an academic career in Nautical Archaeology with a focus on East Asian Seafaring. After entering the Nautical Archaeology Program at Texas A&M University, he was involved with a number of maritime archaeological projects in Japan. He completed his MA in 2008. His MA thesis focused on the reconstruction of the ill-fated Mongol fleet that was destroyed by "the divine wind" at the battle of Koan in 1288. He is currently conducting field work in Vietnam, aiming to find another ill-fated Mongol fleet in that country. He is the author of the books *The World History Based on Shipwrecks* (Media Factory/New Book Series. Tokyo, Japan, 2011), *The Archaeology of Kamikaze: Revealing the Secret of Mongolian Navy* (Texas A&M Press, in final review).

He is currently working as a city archaeologist at Fukuoka Japan while completing his PhD Dissertation.

Rodrigo Torres

Rodrigo Torres is a Brazilian Oceanographer and Archaeologist. In the last 12 years he specialized in applied oceanography and nautical archaeology, with acquired skills in the fields of shipwreck archaeology, site formation processes, digital cartography (G.I.S.), museology and scientific diving. He is currently enrolled as a PhD student in the Nautical Archaeology Program at Texas A&M University, sponsored by the Brazilian Ministry of Education and the Fulbright Commission. His PhD research focuses on nineteenth-century Atlantic maritime culture and its influence on the modernization of Brazilian port cities after 1808. He conducted fieldwork on the archaeological investigation of stranded shipwrecks found along the southernmost Brazilian shore, aimed at understanding cultural and natural formation processes which affect the distribution of shipwrecks along the coast. More recently he begun the assessment of a number of shipwreck sites from the Colonial period in Brazil, salvaged by treasure hunters in the 1980's. Realizing that even salvaged and heavily looted shipwrecks can still yield enormous amounts of information if properly studied, this project aims at reviewing the history behind these ships and their explorations, and assess the potential for future research.

Kotaro Yamafune

Kotaro Yamafune completed his B.A in History at Hosei University (Japan) in 2006 and started his MA in the Nautical Archaeology Program at Texas A&M University in 2009. His research interests are Portuguese shipbuilding and seafaring in the 16th and the 17th centuries, and the reconstruction of the Medieval and Post Medieval shipwrecks. His thesis focused on late 16th and early 17th century Japanese Namban art, which displays the first European activity in Japan. He completed his MA in 2012 and is currently enrolled as a PhD student in the Nautical Archaeology Program. His dissertation focuses on the 3D reconstruction of Portuguese India trading ships of the 16th and 17th centuries. During his study at Texas A&M University, he participated in the WWII Cultural Heritage Project in Saipan in 2010 (conducted by Flinders University) and is currently an active member of the Anxum Project in Italy (Texas A&M University and University of Udine), the Gnalić Project in Croatia (Texas A&M University and University of Zadar), and the Project of the Battle of the Itaparica in Brazil (Texas A&M University, Netherlands Cultural Heritage Agency and University of Bahia).

Kotaro Yamafune also specializes in the reconstruction of ship and shipwreck sites using 3D software, such as Autodesk MAYA© and Rhinoceros©. A sample of Yamafune's work on 3D reconstruction and modeling can be seen at:

http://www.youtube.com/user/kotaro0321.

Graduated

Since 2001 twenty students completed their graduate work and are currently studying or on the job market.

Katie Custer (MA 2004)

Wrought Iron Hand Tools from the Underwater Archaeological Excavations of Colonial Port Royal, Jamaica, C. 1692.

Gustavo Garcia (MA 2005)

The Rincón Astrolabe Shipwreck.

Timothy Kane (MA 2006)

Influence and Evolution: The Development of the Batten Lug Sail.

Hiroaki Miyashita (MA 2006)

Ancient Ships of Japan.

Alex Hazlett (PhD 2007)

The Nao of the Livro Nautico: Reconstructing a Sixteenth Century Indiaman from Texts.

Tiago Fraga (MA 2007)

Santo António de Tanna: Story and Reconstruction.

Sarah Kampbell (MA 2007)

The Pantano Longarini Shipwreck: A Reanalysis.

Erika Laanela (MA 2008)

Instrucción Náutica (1587) by Diego García de Palacio: an Early Nautical Handbook from Mexico.

Blanca Rodriguez (MA 2008)

Standardization of Spanish Shipbuilding: Ordenanzas para la Fabrica de Navios de Guerra y Mercante - 1607, 1613, 1618.

George Schwarz (MA 2008)

The History and Development of Caravels.

Randall Sasaki (MA 2008)

The Origin of the Lost Fleet of the Mongol Empire.

Vincent Valenti (MA 2009)

Transitions in Medieval Mediterranean Shipbuilding: A Reconstruction of the Nave Quadra of the Michael of Rhodes Manuscript.

John Eastlund (MA 2010)

No thesis option.

Paul Creasman (PhD 2010)

Extracting Cultural Information from Ship Timbers.

Lilia Campana (MA 2010)

Vettor Fausto (1490-1546), Professor of Greek and Naval Architect: a New Light on the 16th -Century Manuscript Misure Di Vascelli Etc. di…Proto Dell'Arsenale di Venetia.

Courtney Higgins (MA 2012)

The Venetian Galley of Flanders: from Medieval 2-Dimensional Treatises to 21st Century 3-Dimensional Model.

Kota Yamafune (MA 2012)

The Portuguese Century in Japan and the Nanban Screens.

Bry Dubard (MA 2013)

The Key to All the Indies: Defense of the Isthmus of Panama

Laura Gongaware (MA 2013)

Treasure Hunting: Three Case Studies.

Coral Eginton (MA 2013)

Dutch ship pharmacies.

Research Associates

The ShipLAB cooperates with scholars from different universities and research institutions in several continents, trying to create opportunities for our students to travel, network and become acquainted with the field.

Massimo Capulli
Università degli Studi di Udine, Italy

Tânia Casimiro
Instituto de Arqueologia e Paleociências, Universidade Nova de Lisboa, Portugal

Miguel San Claudio
Arqueonauta SL, Spain

Denise Gomes Dias
Universidade do Estado da Bahia, Brazil

Marta Dominguez
Nederlands Centrum voor Dendrochronologie, Netherlands

Francisco Contente Domingues
Universidade de Lisboa

Pierre Drap
Images and Models team (I&M), Laboratory of Sciences of Information and Systems, UMR CNRS 7296 , Marseilles, France

Nuno Fonseca
Instituto Superior Técnico, Technical University of Lisbon, Portugal

Rosa Varela Gomes
Instituto de Arqueologia e Paleociências, Universidade Nova de Lisboa

Roberto Junco
Instituto Nacional de Antropologia e Historia, Mexico

Jorge Semedo de Matos
Escola Naval de Lisboa

Paulo Monteiro
Instituto de Arqueologia e Paleociências, Universidade Nova de Lisboa, Portugal

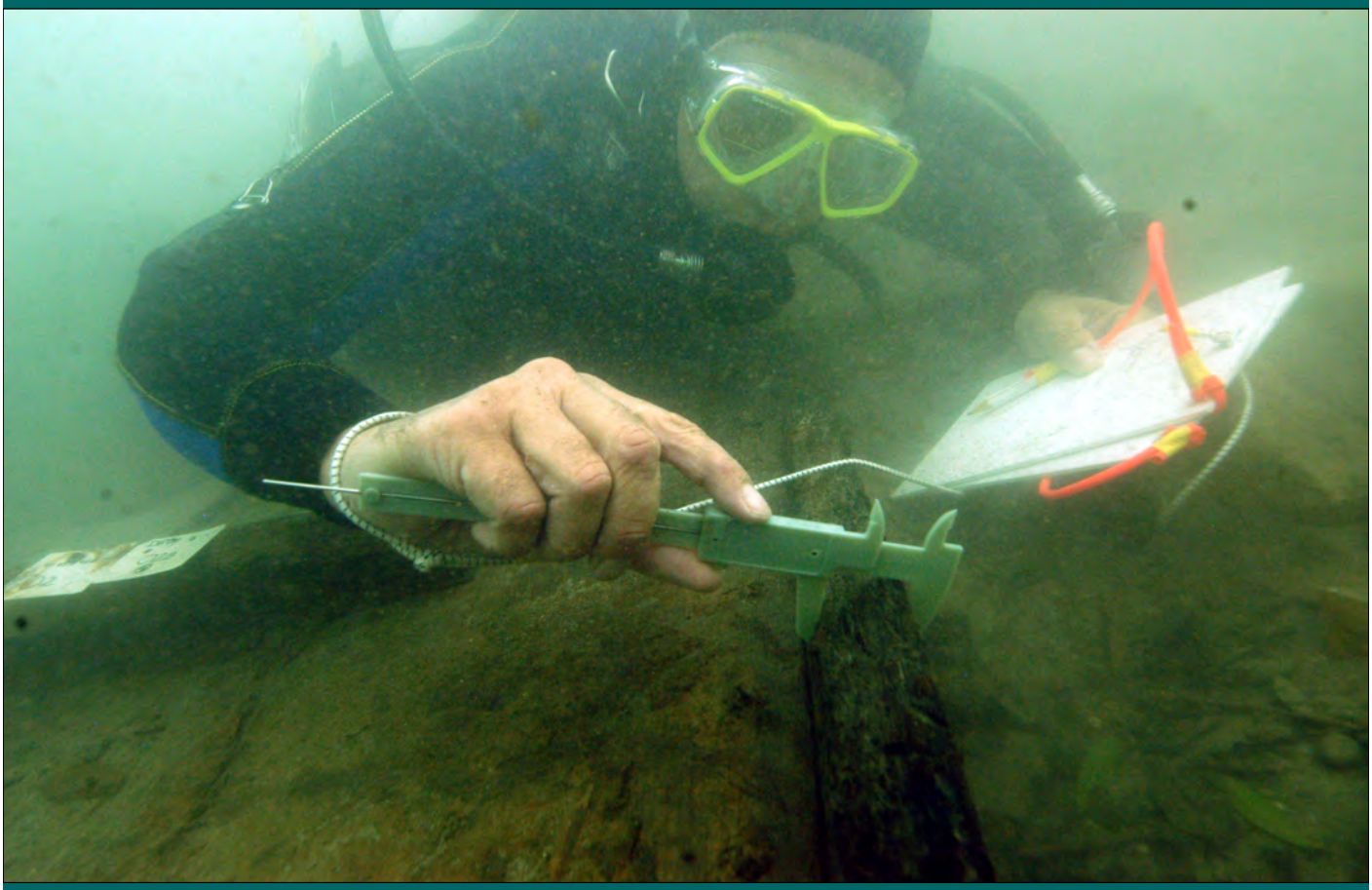
Irena Radic Rossi
Department of Archaeology, University of Zadar, Croatia

Flor Trejo
Instituto Nacional de Antropologia e Historia, Mexico

Submerged Cultural Heritage

Featured

Projects



Submerged Cultural Heritage

1996 -

The ShipLAB condemns the destruction of the underwater cultural heritage by looters and treasure hunters. We believe that treasure hunters and archaeologists cannot work together because our activities have different objectives. The goal of treasure hunting is profit. It is understandable that its investors expect the best return for their investments. A for-profit company that allocates time to carefully excavate an archaeological site, or spends money to preserve artifacts without market value, will be replaced by any company with a more efficient focus on the extraction and sale of artifacts that possess market value.

Mentions of our Work

Pringle, H., "Troubled Waters for Ancient Shipwrecks," in *Science*, 340.6134: 802-807.

Smith, R., "Shipwreck in the Forbidden Zone" *National Geographic Magazine*, October 2009, p. 4-15.

Pringle, H., "Profiteers on the High Seas," *Archaeology Magazine* (2007) 60.4.

Bruhns, A., "Wrack-Forscher in der Prarie." *Der Spiegel* (2006) Special Nr.3: 40-45.

Colapinto, J., "Secrets of the Deep. The Dispute Over What May Be the Biggest Sunken Treasure Ever Found" *The New Yorker* (April 7, 2008): 44-55.

Jackson, T., "Institute of Nautical Archaeology," *Wooden Boat*, (2003) 22: 2-15.

Books

Castro, F. and Thomas, L., eds., *ACUA Underwater Archaeology Proceedings of the 2011 Annual Meeting of the Society for Historical Archaeology*. Columbus, OH: ACUA and PAST Foundation, 2011.

Keynote Addresses, Invited Talks, Panels, and Workshops

Castro, F., Keynote Address. *The Two Cultures.* Breaking the Surface. International Meeting on marine Robotics. Murter, Croatia, 1-9 October 2012.

Castro, F., *Atlantic Nautical Archaeology: Some Case Studies*, in Ottoman Seas: from Mediterranean to Indian Ocean. Institut Françaisd'Etudes Anatoliennes, Istanbul, Turkey, 24-28 March, 2012.

Castro, F., *Nautical Archaeology*: *Excavation, Recording and Reconstruction*, UNESCO Conference "Shipwreck at Gnalić," Biograd, July 5th, 2011.

Castro, F., *2010 Summer Season in the Upper Adriatic Region*, Brown Bag Talks, Anthropology Department at Texas A&M University, October 2011.

Castro, F., *Dendrochronology and the Ships of the Age of Exploration*, Meeting of the Iberian Heritage Project - Filling the Blanks in European dendrochronology: building a multidisciplinary research network to assess Iberian wooden cultural heritage worldwide. The Netherlands Organization for Scientific Research, Nederlands Centrum voor Dendrochronologie, Amersfoort 16-17 September 2011.

Castro, F., *Inventorying Underwater Cultural Heritage and proper management of archaeological sites,* UNESCO Caribbean Meeting on the Protection of the Underwater Cultural Heritage. Kingston, Jamaica, 10 -11 May 2011.

Castro, F., *Toward an Interdisciplinary Computing: Workshop* 2, Tucson, AZ, April 28-30 2011.

Castro, F., Invited Panelist. *The UNESCO Convention and its*

collateral effects on the businesses of marine construction, salvage, oil and gas and the real impact on shipwreck exploration and archaeology. UI Shipwreck Track, New Orleans, 9-11 February, 2010.

Castro, F., *The Nautical Archaeology Program at Texas A&M University and the 2001 UNESCO Convention on the Submerged Cultural Heritage*, Penn-Brock Workshop on Law and Ethics in Underwater Archaeology, Brock University, St. Catharines, Ontario, Canada, October 22-25, 2009.

Castro, F., Gulf Coast Maritime Archaeological Database Workshop, Texas A&M University, Texas, Invited by the National Oceanic and Atmospheric Agency. May 7-8, 2003.

Castro, F., *The Pacific Coast Maritime Archaeological Summary Workshop*, Santa Barbara, California, Invited by the National Oceanic and Atmospheric Agency and the Santa Barbara Maritime Museum. September 9 -11, 2002.

Castro, F., *Treasure Hunting in Portugal: a doomed strategy*. Brown Bag Talks, Anthropology Department, Texas A&M University, 1999.

Castro, F., *História da Arqueologia Subaquática em Portugal* at Escola Secundária da Cruz de Pau, 1997.

Castro, F., *Acções de formação em arqueologia subaquática de Arqueonáutica Centro de Estudos* at Escola Secundária da Cruz de Pau, 1997.

Castro, F., *A Arqueologia Subaquática em Portugal* at Residência de Estudantes da Avenida, Lisboa, 1996.

Castro, F., *A Arqueologia Subaquática* at Residência de Estudantes da Avenida, Lisboa, 1995.

Castro, F., *Arqueonautica Centro de Estudos*, at Meeting "Patrimoine Culturel Subaquatique, Un Heritage pour le Futur", Mostra Atlântica de Televisão 95, Angra do Heroísmo, Azores, Portugal, 27-29 October 1995. Invited by the Azorean Regional Government.

Communications at International Meetings

Castro, F., Monteiro, P., and Casimiro, T. *Shipwrecks and Politics: The Portuguese Case Study*, 46th Annual Meeting of the Society for Historical Archaeology, Leicester, UK, January 9-12, 2013.

Castro, F., *Being a Nautical Archaeologist*, First Centre for Portuguese Nautical Studies Maritime Archaeology Conference. Paper read by Mr. Tiago Fraga. Eastern Cape, South Africa, 7 to 9 August 2004.

Publications

Castro, F., "Archaeologists, Treasure Hunters, and the UNESCO Convention for the Protection of the Underwater Cultural Heritage: a personal viewpoint," in *Odyssey Marine Exploration Papers 13: Proceedings of the Underwater Intervention Conference*, New Orleans 2010 :7-9.

Wachsmann, S., Dunn, R. K, Hale, J. R., Hohlfelder, R. L., Conyers, L. B., Ernenwein, E. G., Sheets, P., Blot, M. L., Castro, F., and Davis, D., "The Paleo-Environmental Contexts of Three Possible Phoenician Anchorages in Portugal," International Journal of Nautical Archaeology, (2009) 38.2: 221-253.

Alves, F. and Castro, F., "New Portuguese legislation on management of the underwater cultural heritage," in *Conservation and Management of Archaeological Sites*, James and James Science Publishers, Vol. 3, 1999:159 -162.

Same text in: *Background Materials on the Protection of the Underwater Cultural Heritage,* Volume 2. Paris: *UNESCO, 2000:*307-312**.**

Castro, F*.,* "O naufrágio da fragata espanhola *Nuestra Señora de las Mercedes*, afundada pelos ingleses ao largo do Cabo de Sta. Maria, em 1804"*, Revista Portuguesa de Arqueologia* (1998) 1.2:219-230.

Alves, F., Alarcão, A., Alarcão, J., Castro, F., and Filgueiras, O.L., *Arqueologia ou Caça ao Tesouro? LIVRO BRANCO - Para um debate sobre a legislação do património arqueológico subaquático em Portugal*, 30 pages, Lisbon: Arqueonáutica Centro de Estudos, 1995.

Reports

Castro, F., *Relatório dos trabalhos preliminares de organização do projecto de inventário de sítios arqueológicos subaquáticos na zona de acesso a Lisboa, ISAS 01*, on file in IPA/CNANS' library, 2001.

Castro, F., Aditamento ao 'Catálogo dos cepos de âncora em chumbo encontrados em águas portuguesas', publicado n'*O Arqueólogo Português*, série IV, 6/7, 1988-1989, p.109 -185. CNANS, Abril 1998, IPA/CNANS, 1998.

Castro, F., *Relatório da missão de acompanhamento do projecto de reconhecimento arqueológico subaquático nas imediações da cidade de Angra do Heroísmo, Ilha Terceira, Açores*, IPA/CNANS, 1997.

Alves, F., Castro, F., *Relatório da missão de verificação de um achado fortuito de um canhão na praia das Avencas (Cascais)*, IPA/CNANS, 1997.

Graduate Work

Coral Eginton, *Dutch Ship Pharmacies* (MA 2008– 2013).

Laura Gongaware, *Treasure Hunting: Three Case Studies* (MA 2006-2013).

Pearce Paul Creasman, *Extracting Cultural Information from Ship Timbers* (PhD 2005-2010).

Katie Custer, *Wrought Iron Hand Tools from the Underwater Archaeological Excavations of Colonial Port Royal, Jamaica, C. 1692* (MA 2000-2004).

Newsletter Articles

Castro, F., "Underwater Archaeology in Portugal: Policies, Budgets and Results", *INA Quarterly* (1998) 25.4: 16-18.

Working on the Gnalic Shipwreck
(Photo: S. Govorcin, 2012)

Popular Articles

Castro, F., "Contra los cazatesoros y la incuria arqueológica" *ABC* (February 25, 2012).

Castro, F., "The ShipLab", *CMAC News and Reports*, (2009) 1.1: 6-10.

Castro, F., "Center for Maritime Archaeology and Conservation Lecture Series", *INA Quarterly*, (2006) 31.1: 21-22.

Castro, F., "Caçadores de tesouros: proposta de uma taxonomia" in *História e-história*, (*http://www.historiaehistoria.com.br/*, January 2005.

Castro, F., "Institute of Nautical Archaeology: 31 anos de arqueologia subaquática." *Mundo Submerso* (2004) 7.82: 60-64.

Castro, F., "Arqueologia em águas profundas." *Mundo Submerso (*2004) 7.83: 60-64.

Castro, F., "Arqueólogos e caçadores de tesouros." *Mundo Submerso* (2004) 7.84: 51-53.

Castro, F., "Depois dos mergulhos." *Mundo Submerso* (2004) 7.85: 68-71.

Castro, F., "A palavra aos mergulhadores." Mundo *Submerso* (2004) 7.87: 60-63.

Castro, F., "Três projectos de arqueologia subaquática nos EUA – Parte 2." *Mundo Submerso* (2004) 7.90: 68-72.

Castro, F., "Três projectos de arqueologia subaquática nos EUA – Parte 1." *Mundo Submerso* (2004) 7.90: 68-72.

Castro, F., "Os naufrágios do Baleal." *Mundo Submerso* (2004) 7.91: 68-72.

Castro, F., "Pequeno comentário sobre a intervenção de salvamento arqueológico subaquático na baía de Angra", *A União*, June, 1998.

Castro, F., "Arqueonáutica, uma associação pioneira no estudo e salvaguarda do património arqueológico náutico e subaquático em Portugal – I" *A União*, January 11th, 1997.

Castro, F., "Arqueonáutica, uma associação pioneira no estudo e salvaguarda do património arqueológico náutico e subaquático em Portugal – II" *A União*, January 18th, 1997.

Castro, F., "Arqueonáutica, uma associação pioneira no estudo e salvaguarda do património arqueológico náutico e subaquático em Portugal – III" *A União*, January 25th, 1997.

Castro, F., "Arqueonáutica, uma associação pioneira no estudo e salvaguarda do património arqueológico náutico e subaquático em Portugal – IV"*A União*, February 1st, 1997.

Castro, F., "Achado Fortuito", *Notícias do Mar* (1996) 11.126: 30-31.

Castro, F., "A caça ao tesouro... dos investidores", *Notícias do Mar* (1996) 11.125: 30-31.

Castro, F., and André de la Porte, S., "Tradução e introdução ao texto de George F. Bass 'O Homem que Roubava as Estrelas'" *Mar & Transportes* (1996) 2.6: 31-33.

Same text in *Correio de Arqueonáutica* (1995) 2.

Castro, F., "Arqueologia Subaquática, Onde Param os Responsáveis?(2)", *Notícias do Mar* (1995) 10.118.

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Figueiredo, L., "Naus portuguesas são alvo fácil de caça tesouros," *Diário de Notícias*, May 5, 2008.

Working on the Stella 1 shipwreck
(Photo: M. Capulli 2012)

Ivo, N., "Filipe Vieira de Castro. Arqueólogo Naval," *Notícias Sábado*, 6 September 2008.

Machado, A., "O tesouro mais bem guardado do mundo," *Público*, 10 November 2008.

Pires, L., "A Costa dos Tesouros," *Casual*, 24 August 2007.

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Rodrigo Torres

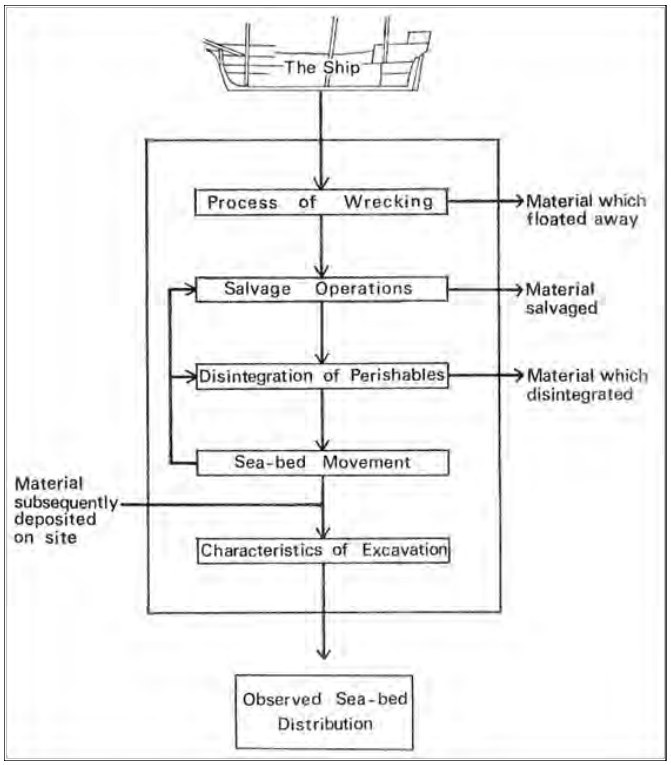
Stranded Shipwrecks of Southern Brazil

2010

In the southernmost coast of Brazil, an extensive and scarcely populated sandy shore nearly 400mi long, is home of stranded ships representing various periods of navigation in the southwestern Atlantic (Annex 1). Preliminary investigations suggest a greater occurrence of maritime accidents in the last 200 years, especially in the nineteenth-century, due to the losses of merchant sailing vessels engaged in newly opened trading routes between Europe, North America, Southern Brazil and River Plate provinces.

In fact, the nineteenth-century was an interesting period filled with opportunities for the nations situated along the margins of the Atlantic rim. New political conditions and the liberalization of seaborne commerce early in the century provided conditions for Brazilian port cities to engage Atlantic trading networks. By this time, the Atlantic Ocean was already a well-established commercial and cultural venue, where merchant vessels from various parts of the world transported goods, peoples and ideas along with the development of modern economics. In southern Brazil, the small port city of Rio Grande would hence flourish as an important commercial center of Atlantic South America.

The main goal of this research is to study late modern Atlantic mercantile maritime culture through the archaeological investigation of stranded shipwrecks found in the intertidal zones of the Rio Grande do Sul seashore, southern Brazil. The shipwrecks were found partially buried in wet and dry sections of the beach. These sections profile an alternation of cyclical (seasonal) and non-cyclical (meteorological) events such as natural flooding, burial and exposure. These events have significant implications for the preservation of the materials studied, for the distribution of the wreck remains and the interpretation of archaeological data (Torres, 2012). The methodological approach will focus on understanding the cultural and natural formation processes behind the occurrence and distribution of the shipwrecks.



Flow diagram showing Muckelroy conceptual model of cultural and natural factors involving the development of a wreck site (After Muckelroy, 1978: 282).

Stranded shipwreck sites often occur in highly dynamic sedimentary environments, posing major challenges in terms of preservation and coherence of the archaeological data. Beach environments are among the most energetic and complex depositional systems in the world's oceans (King, 1972; Zenkovich, 1967), where multi-directional wind, waves and currents affect sediment transportation and depositional patterns, as much as it does with artifact distribution on the wreck site. These sites typically consist of widely scattered materials

located either in the intertidal zone or above the high-tide line. The literature refers to these sites as 'scattered' or 'scrambled' (see Delgado, 1984, 1985, 1997; McNinch *et al.*, 2006; O'Shea, 2002; Russel, 2002; Muckleroy, 1975).

Understanding the particularities of wreck sites formation has been a focus in the field of shipwreck archaeology since its origins in the 1960's (Dumas, 1962; Bass, 1966). It initially developed around issues of defining wreck sites typologies and discussing the coherence of archaeological record in relation to the physical characteristics of the underwater environment (Dumas, 1962, 1972; Frost, 1962; Muckelroy, 1977).

Due to the privileged nature of incredibly rich wreck sites off the Mediterranean coast, where the 'microcosms' of ancient people have been investigated since the 1960's, the sub-discipline of nautical archaeology has mostly been associated with the excavation of well-preserved, near-pristine shipwreck sites (see Bass, 1972; 1983). Early publications have thus somewhat disregarded the significance of shallow and scattered ship remains, due to their presumed little coherent information content (Dumas, 1962, 1972; Frost, 1962).

The proposed approach to the problem of interpretation of shore stranded shipwrecks in southern Brazil will be delimited by three analytical instances, or contexts: 1) the coherence of structures and artifacts at individual sites; 2) their distribution in space; along the Rio Grande do Sul seashore, as well as in time; and 3) the southwest Atlantic Ocean as a space for the circulation of maritime culture, where the merchant ship and its material culture are part of a macro-regional sphere of circulation of goods, people and ideas during the late Modern period.

Site 3: NAV Fakir (Rodrigo Torres)

Together with a team of archaeologists and geomorphologists from the Federal University of Rio Grande in Brazil, we started in 2011 a field experiment in site formation processes, designed to provide a base for long term monitoring of the archaeological remains in relation to environmental variability in these exceptionally dynamic wreck sites. A pilot site was thus chosen and benchmarks were installed in a convenient position near the wreck. Each hull feature was tagged with five permanent control points and surveyed with the aid of a digital topographic instrument (Total Station).

Site 1: NAV LG Peixe (Rodrigo Torres)

Samila Ferreira

Policies of Memory, Politics of Forgetting. São Lourenço do Sul, Brazil

2013 - Co-Chair: Tom Green

Samila Ferreira's research focuses on heritage policies, the enhancement of social memory and its effects on the representation/oblivion of social groups in multicultural/multiethnic contexts. In her work she analyzes public policies in view of their effects towards constructing and promoting narratives of the past. Language, power, and politics make our past, and public policies, monuments and legislation are the tools with which the narratives are created by every generation.

The city of São Lourenço do Sul in Brazil is located on the west shore of the Patos Lagoon. The city began to receive free laborers in 1858 with the arrival of immigrants from different parts of Europe, especially Germany and the now extinct Pomerania, occupying and cultivating agricultural properties in southern Brazil. Early on this colonial enterprise came to depend on water transportation for the transport of crops from and supplies to the farms. This transport was done with sailing schooners, regionally known as *Iates*, thereby integrating the colonial region with other navigation lanes into the Patos Lagoon. Over the years, the demand for schooners in this trade attracted many Iates to São Lourenço do Sul city, whose operation expertise and seamanship was mostly Portuguese.

Since 2005, the municipal administration has officially developed public-private collaborations in order to disseminate and promote the German-Pomeranian immigrant culture in the towns and region. This initiative, mainly linked to tourism, has emerged as an economical alternative for the descendants of immigrants living in the rural area. The area experienced frequent economic swings as production declined and a colonial monoculture, especially tobacco, was established, impoverishing the local population. Since the 1970's a rural exodus of many young people is taking place, who seek for opportunities outside of the rural context.

José Antônio de Oliveira Guimarães House
(Portuguese landowner and partner of the immigrants settlement area) – In 1888

José Antônio de Oliveira Guimarães House - 2010

In this study the interaction of at least two ethnic groups with the Portuguese is highlighted. According to Llorenç Prats all expressions of cultural identity are ideological in the sense that they are based on narratives, ideas, values and prejudices. Collective memories in any single community are frequently different for different social and cultural groups, and the state sponsorship of any particular narrative risks the establishment of a collective memory that silences important voices or historical events. **(REF)**

Jacob Rheingantz House
(German partner of a settlement enterprise) – Early of 20th centuries

Jacob Rheingantz House –
Museum of Immigrant 2010

We will discuss the problems related to the establishment of official narratives, collective memories and collective amnesia, and their relations with the social, cultural, economical and political factors at play.

As Foucault suggested, individual and collective identities are the result of our experience and most people accept the reality that the media and the existing institutions present. In this sense, all collective memories silence important parts of the past and represent only the version of the ruling class serving their specific purpose. Morality, truth and meaning depend on knowledge and experience, and are embedded in culture, with its consensus and collective narratives of the past and the relations between the different cultural and social groups interacting in any given community.

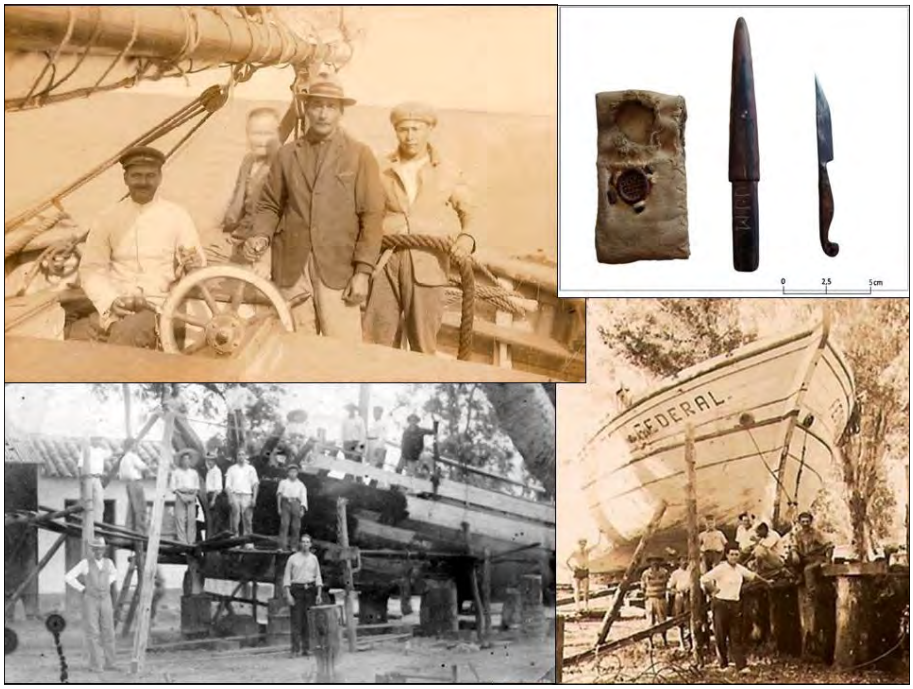
We will frame the question of collective memory as well as collective amnesia in São Lourenço do Sul, in the cultural, social and economical context of this multicultural community. We will then analyze the construction of collective memories and consciousness in the social context of the different powers at play between the dominant and subordinate groups.

Publications

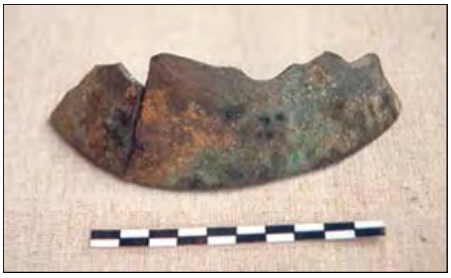
Ferreira, S. P. "O espaço portuário da cidade de São Lourenço do Sul: um lapso de memória?" In: Michelon, F. F.; Lima, P. G. (Org.). *Cadernos Memória e Patrimônio: políticas e acervos*. Pelotas: EGUFPel, 2009, p. 251-264.

Ferreira, S. P., Dode, M., Valenti, R., "Educação Patrimonial e Arqueologia no Projeto de Restauração da Capela do Taim/RS," 2008.

Thiesen, B. V.; Ferreira, S. P. . "Isolamento e Exclusão: Os



Clockwise: (1) Aboard in the late *Jaguarão*; the man wearing the white clothes is the late's master, at the helm is a sailor, the boy in the background holding the rope is the apprentice, and the man sitting in the background is the renowned photographer of that time, Bruno Pruské. Undated, author's personal collection. (2) Personal tools of sailor Mr. Lourenço Martins. From left to the right: thimble, fid and small knife for cutting up points. Recorded by the author on 01/04/2010. (3) Roveré Shipyard workers in São Lourenço do Sul. Undated. Mrs. Iolane Roveré Montezuma Personal archive. (4) Roveré Shipyard workers repairing the late *Federal*. Undated. Mrs. Iolane Roveré Montezuma Personal archive.



Samuel Cuellar

A History of Ship Bells

2012-

The early use of bells on ships may be related to the necessity of signaling a vessel's presence in the fog. However, only a handful of ship bells are known historically and archaeologically from the period dating before AD 1705. To make better sense of the centuries represented, we sorted them by date below along with its known information.

The goal of this study is to determine when, where, and why bells appeared aboard ships in Europe, sometime prior to the mid-to-late 15th century.

Bell allegedly recovered by sport divers from a shipwreck site near Figueira da Foz, Portugal, possibly the Spanish ship *San Salvador*, lost in that area in 1555 (Courtesy CNANS).

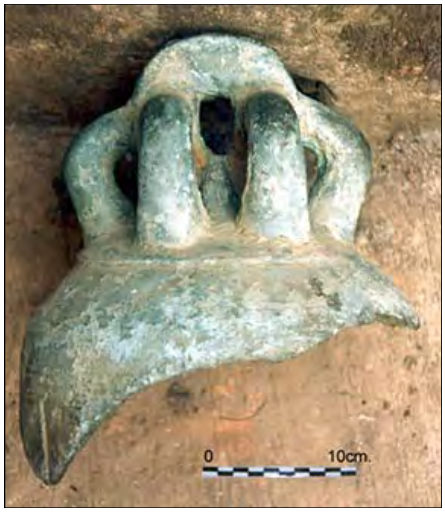
Both archaeological and historically known bells will be used to analyze religious, practical, and decorative functionality in relation to shipboard life and as compared to know land-based bells in churches and elsewhere.

Above: Fragmnet of a bell from São Julião da Barra, Portugal (Courtesy CNANS).

By defining these factors, a better understanding of the circumstances leading up to their placement aboard ships can be realized. In addition, a survey of all known and accessible extant archaeological bells will be done to determine if certain characteristics can provide an accurate designation of date and country of origin. These will include size and weight, physical markings, inscriptions, decorative elements, metal composition, and shape and construction method.

Possible fragment of a bell from São Julião da Barra, Portugal (Courtesy CNANS).

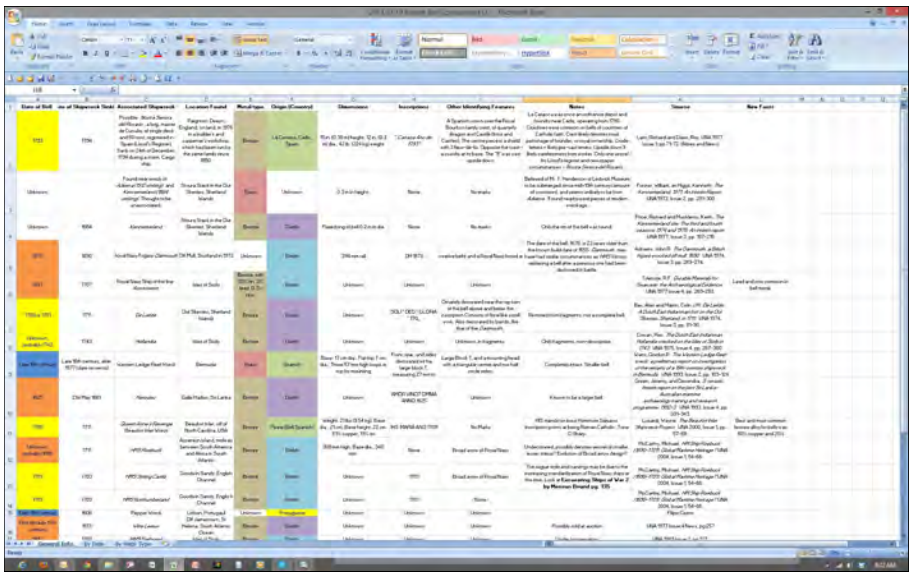
A handful of ship bells are known historically and archaeologically from the period dating before AD 1705. To make better sense of the centuries represented, they have been sorted by date.



Fragment of a bell from Cabo Raso, Portugal, from the site of the 1696 shipwreck of an Italian ship named *Grande Principessa di Toscana* (Courtesy CNANS).

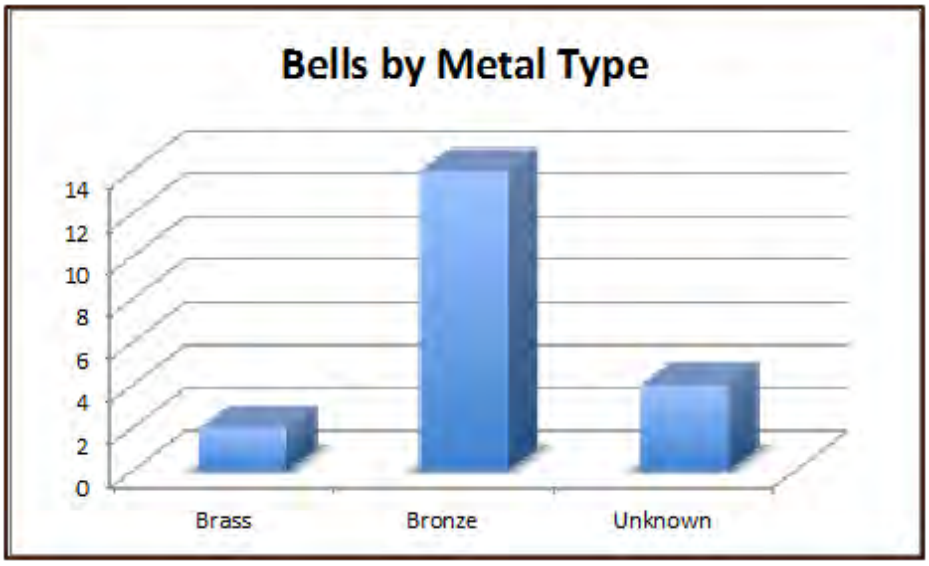
A database of all known information regarding archaeological and historical ship bells through 1750 is being developed to aid in determining the extent of relevant examples that have been discovered either through excavation, chance, or in historical archives. It is hoped that by sorting these bells by date, country, metal composition, and stylistic features, a better understanding of ship bell evolution will be re-

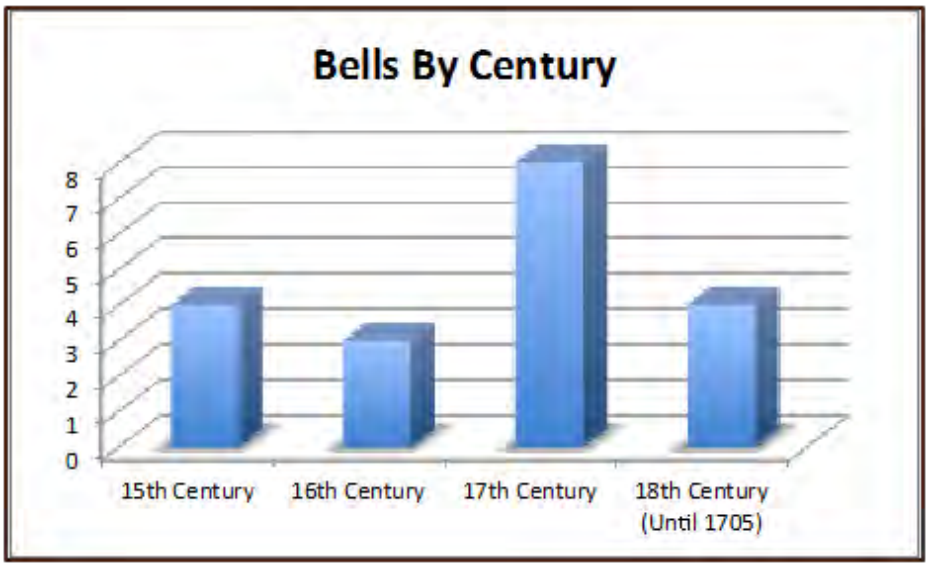
vealed. Another goal of this database is to provide quick and easy access to information for researchers. By providing a centralized location of known ship bell data, identification of a shipwreck's time period and country of origin may prove expedited through the use of the bell, if found.



Spreadsheet with basic information on bells (Sam Cuellar).

The successful creation and completion of this database depends on the accessibility and accurate reporting of ship bell data. In several examined archaeological reports, data provided are either incomplete or missing in its entirety, other than a passing mention a ship bell was recovered. Likewise, bells have been recovered by local fishermen, treasure hunters, and sport divers and rest in private collections or are housed in museums where they sit unstudied. Bringing these sources to light is essential to an accurate picture of ship bells prior to 1750.





At this stage of the research we are collecting data from archaeological publications, historical accounts, and iconographical evidence.

We hope to gather enough information to reconstruct the history of ship's bells in the North Atlantic and the Mediterranean.

Gnalić Shipwreck Croatia

2011 -

Directed by Irena Radic Rossi, Filipe Castro and Peter Fix, the Gnalić Project is a multidisciplinary project promoted by the Municipality of Biograd na moru and launched by the University of Zadar, Texas A&M University, and the Forum of the Adriatic and Ionian Cities. It is supported by the Croatian Ministry of Culture, the Homeland Museum of Biograd, the Institute of Nautical Archaeology, the Center for Maritime Archaeology and Conservation at Texas A&M University, the Institute of Art History – Center Cvito Fiskovic in Split, the Museum of Ancient Glass in Zadar, the Faculty of Electronic Engineering and Computing of the University of Zagreb, the National Museum in Zadar, Croatian Historical Institute in Zagreb, University of Split, Department of Conservation and Ruđer Bošković Institute's Division for Marine and Environmental Research, the Polytechnic University of delle Marche, in Ancona, the University of Patras – Department of Geology, in Greece, the CNRS, both through the Musée de la Marine and the Laboratory of Sciences of Information and Systems at Marseilles, and the Museo della Marineria di Cesenatico.

2011 Field Season

The Gnalić shipwreck lies a little over three nautical miles from Biograd na Moru, Croatia. It was discovered by sport divers in the early 1960s, lying at a depth between 25 and 29 meters, near the Gnalić Island, at the entrance of the Pašman channel. Several archaeological interventions under the direction of Ksenija Radulić, in the late 1960s and early 1970s, and under the direction of Zdenko Brusić in 1990s, exposed the archaeological remains of a large ship dated to the late 16th century. The extension of the site and the amazing preservation of the ship remains and its cargo make it one of the most interesting early modern shipwrecks known.

The ship's preserved cargo consists of a rich assortment of glass vessels, mirrors, window panes, brass chandeliers, silk, cotton shirts, shaving razors, pins, needles, candle snuffers, brass bells, spectacles, and raw materials, such as cinnabar, lead carbonate, mercury, antimony, sulfur, brass wire, and brass sheet. Determining the provenience and destiny of all these items will shed light on the nature of commerce routes in the eastern Mediterranean world of the late 16th century.

Glass panes shipped on the *Gagliana grossa* from Venice to Constantinople , for the new harem quarters in Sultan Murad III's palace.

2012 Field Season

In the summer of 2013 we will revisit the site and try to excavate a trench to assess the extension and preservation of the ship's hull.

Invited Talks

Castro, F., *The Gnalić Shipwreck*, INA Board Meeting, College Station, October 2011.

Publications

Rossi, I., and Castro, F., "The Gnalić Shipwreck – The Mirror of the Renaissance Europe," *INA Quarterly* (2012) 39.1-2: 30.

Bondioli, M., and Nicolardi, M., *Il contributo delle fonti d'archivio per l'identificazione del relitto di Gnalić.* Unpublished Report, 2012.

Stella 1 Shipwreck Italy

2011 -

The Anaxum project is a collaboaration with the Dipartimento di Storia e Tutela dei Beni Culturali dell'Università di Udine and the Soprintendenza per i Beni Archeologici del Friuli Venezia Giulia. The projects mission is the multidisciplinary study of the River Stella, in Northern Italy, throughout time. In the summer of 2011, a team from ProMare, Texas A&M's Nautical Archaeology Program, and the Institute of Nautical Archaeology was invited to participate in the excavation of a Roman barge: the Stella 1 shipwreck. The work was directed by Massimo Capulli from the University of Udine and Filipe Castro from Texas A&M University, under the scientific supervision of Luigi Fozzati of the Italian Ministry of Heritage and Cultural Activities. The excavation was made possible thanks to the generous support of ProMare, the Center for Maritime Archaeology and Conservation (CMAC), and Dr. Peter and Nancy Amaral, Texas A&M Alumni and long time supporters of the Ship Reconstruction Laboratory / CMAC.

Reports

Castro, F. and Capulli, M., *The Stella 1 Shipwreck - Hull Description – ShipLab Report 14*. On file in Nautical Archaeological Program Library, Texas A&M University, 2011.

Newsletter Articles

Capulli, M., and Castro, F., "Anaxum Project" *INA Quarterly* (2012) 39.3/4: 15.

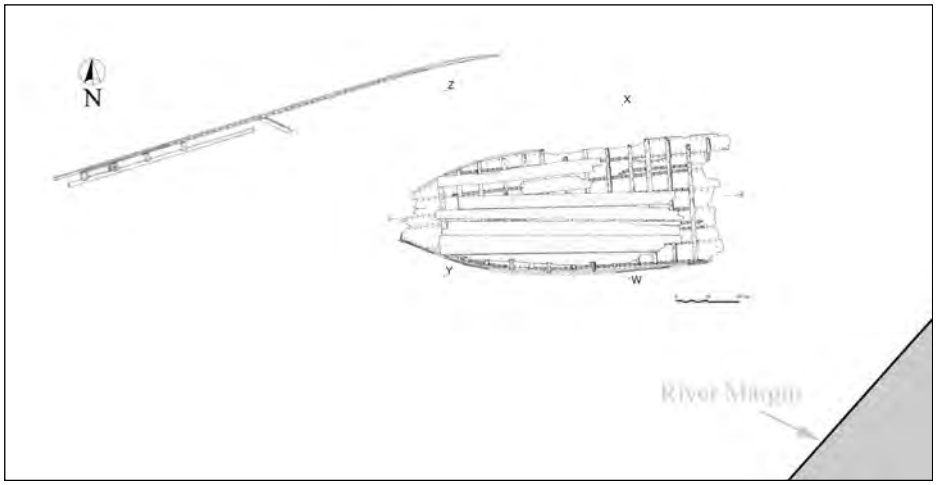
Fozzati, L., Capulli, M. and Castro, F., "The Stella 1 Shipwreck" *CMAC News and Reports*, (2011) 3.2: 17-19.

Communications at International Meetings

Castro, F. and Massimo Capulli. *The Stella 1 Roman Shipwreck: a Laced Vessel in the Upper-Adriatic Region*. International Symposium in Ship and Boat Archaeology, Amsterdam, October 8-12, 2012.

Capulli, M. and Castro, F. *Navi cucite di epoca romana: il caso del relito Stella 1*, in II Convenio Nazionale di Archeologia, Storia, Etnologia Navale: Il patrimonio marittimo e fluviale italiano. Cesanatico, Italy, April 13-14, 2012.

Castro, F., Luigi Fozzati, Massimo Capulli, Ayse Atauz, Dante Bartoli, Kelby Rose, Lindsey Thomas, Kotaro Yamafune, Peter Holt, *The Stella 1 Shipwreck*, 44th Annual Meeting of the Society for Historical Archaeology Annual Conference, Austin, Texas, January 2012.



The Stella 1 laced Roman barge as it was found in situ, with a piece of the mortise and tenon wooden structure, possibly from the embankment, lying nearby at a slightly

The Nautical Archaeology of Puerto Rico

2008 - 2012

Puerto Rico is located on the northeast corner of the Caribbean Basin. Archaeological evidence suggests that the island's first inhabitants arrived between the years 7,000 and 4,000 BCE. Spanish colonization of Puerto Rico began in 1509, under the direction of lieutenant Juan Ponce de León. The strategic location of Puerto Rico was admired since the early 16th century by both friends and enemies of Spain. This project aims at understanding the country's maritime history and vocation through its shipwrecks. In 2008, in cooperation with the Instituto de Investigaciones Costaneras (IIC), a team from Texas A&M University surveyed the coast between the municipalities of Loíza and San Juan. In 2010 we relocated the site of the Rincón shipwreck in cooperation with the Consejo para la Conservación y Estudio de Sitios y Recursos Arqueológicos Subacuáticos, the University of Puerto Rico, and the Historic Preservation Office.

Publications

Castro, F., Fontanez, R., Garcia, G., Tubby, R., Lusardi, W., "The Nautical Archaeology of Puerto Rico" *International Journal of Nautical Archaeology* (2010) 39.1: 156-164.

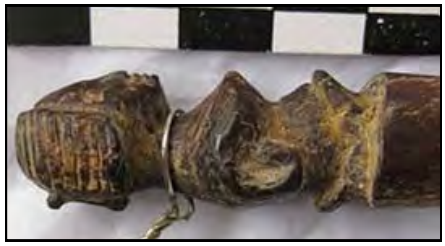
Reports

Castro, F., Fontánez, R., Garcia, G., Tubby, R., and Lusardi, W., *The Nautical Archaeology of Puerto Rico, 2008 Field Season Report*, College Station, 2008.

Surveying the area of the Rincên Shipwreck in 2010 (Photo: Juan Vera - *Consejo para la Conservación y Estudio de Sitios y Recursos Arqueológicos Subacuáticos*

Graduate Work

Gustavo Garcia, *The Rincón Astrolabe Shipwreck* (MA 2000-2005).



Knife or fork handle found on the beach in the year the Rincón Shipwreck was exposed (Photo: Filipe Castro)

Newsletter Articles

Castro, F., Cartellone, C., Vera, J., Fontanez, R., Garcia, G., and Fontanez, A., "The Nautical Archaeology in Puerto Rico: Summer 2010 Field Work" *CMAC News and Reports*, (2010) 2.2: 11-13.

Castro, F., Fontanez, R., Garcia, G., Tubby, R., Lusardi, W., "The Nautical Archaeology of Puerto Rico", *INA Annual*, 2009: 72-79.

Lagos Project Portugal

2006 - 2007

In the nexus of the North Atlantic and the Mediterranean worlds, the Portuguese coast has a rich submerged cultural heritage. The ShipLAB organized a summer school in Lagos, Portugal, during the month of June of 2006, with the support of the municipality. Lagos has a long seafaring tradition and is the place where Prince Henry the Navigator lived and planned the first effective steps of the Portuguese expansion overseas, which lead to the discovery of a maritime route to India.

The **2006 Field Season** was an exploratory mission designed to introduce the landscape, the culture and the history of Algarve to a team of ShipLAB graduate students, and plan a long-term project of inventory, study, and publication of the region' maritime cultural heritage.

Part of the student's time was spent recording artifacts raised by fishermen and sport divers, part diving on known shipwreck sites, and part visiting museums and archaeological sites.

An inventory of recorded shipwrecks was started together with another of underwater sites with archaeological interest.

Stone anchors raised from a fishing site off Praia do Carvoeiro (Fiipe Castro, 2006).

Recording an old anchor found near the city door on the ancient medieval beach.

Book

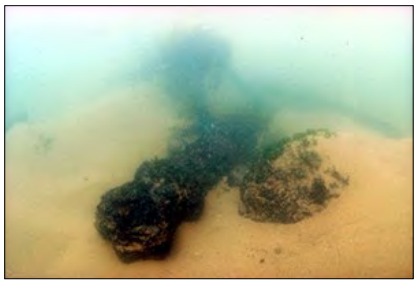
Fraga, T., Marreiros, J., and Jesus, L., *Contos Inacabados: A história submerse de Lagos*. Lagos: Câmara Municipal de Lagos, 2008.

Report

Castro, F., Fraga, T., Creasman, P., DuBard, B., Catsambis, A., Schwarz, G., Koepnick, S., *Lagos Summer School – ShipLab Report 12*.On file in Nautical Archaeological Program Library, Texas A&M University, 2006.

Newsletter Articles

Castro, F., "Lagos Project", *INA Quarterly*, (2007) 34.1: 14-16.



Oeiras Guns

Portugal

2000

Five iron guns were located during the preparation works for the construction of the Oeiras Marina, Lisbon, Portugal. This collection of guns was found to be part of a larger context, corresponding to a shallow shipwreck site dated to the 17th or 18th century, probably extensively salvaged immediately after its occurrence. The guns were removed to an area inside the jetties.

The Site

This site has been known to fishermen for a long time and its shallow location suggests that most of the shipwreck was salvaged over the years.

In the 1980s one gun presumed to come from this site was raised and placed in front of a house located nearby, but it has since rotten away.

Sport diver Paulo Pimentel showed the team an adjacent area where in the winter, when the sediment blade is thinner, he found spikes and other small artifacts lodged in the crevices between the bolders that form the rocky bottom. The erosion on these artifacts, most from cooper alloys, suggests a long exposure to the currents and running sediments. Most of the shipwreck area lies now under the jetty.

One of the guns in situ, concreted to the bedrock, before removal (Photo: Guilherme Garcia.

Area where the guns were found and the wider area where sport divers recovered several artifacts in the 1980s and 190s.

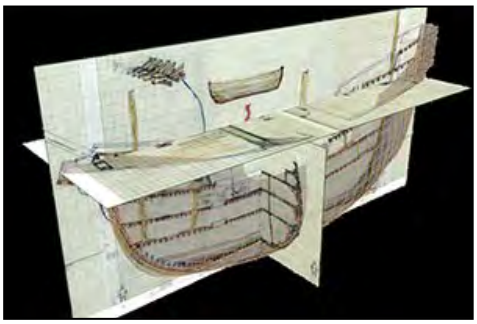
Report

Castro, F., *Relatório dos trabalhos de salvamento de 5 bocas de fogo em ferro encontradas na zona de implatação da Marina de Oeiras*, on file in IPA/CNANS' library, 2001.

Ship Modeling and Visualization Sciences

Featured

Projects



Ship Modeling and Visualization Sciences

2004 -

A cooperation between the Department of Visualization, Texas A&M University, and Centre for Marine Technology and Engineering, Instituto Superior Técnico., Lisbon, Portugal.

During the last four decades computers have continuously changed the way archaeologists work. The ShipLAB works with the Department of Visualization, Texas A&M University and the Centre for Marine Technology and Engineering of Instituto Superior Técnico, to maximize our research capacity and to profit from the important input of these two excellent institutions.

About our Work

Evangelista, J., "Computer Modeling Rebuilds an Ancient Ship." *Surveyor* (Fall 2011) :27-31.

Papers

Miñano, A., Fernández, F. and Casabán, J.L., 2012, Métodos de documentación arqueológica aplicados en arqueología subacuática: el modelo fotogramétrico y el fotomosaico del pecio fenicio Mazarrón-2 (Puerto de Mazarrón, Murcia), SAGVNTVM. Papeles del Laboratorio de Arqueología de Valencia 42, 99-109.

Keynote Addresses, Invited Talks, Panels and Workshops

Castro, F., *A reconstrução virtual de uma nau da Índia: Uma hipótese de trabalho*, Universidade Autónoma de Lisboa, May 23, 2009.

Castro, F., *Computers and Shipwrecks: The Pepper Wreck Reconstruction as a Virtual Hypothesis*, Seminario-Taller en prol de la Protección del Patrimonio Cultural Subacuático, Cartagena de Indias, Colombia Invited by the Colombian Ministry of Culture, paper delivered by Tatiana Villegas.24 to 27 November, 2008.

Castro, F., Fonseca, N., Loureiro, R. and Santos, T. *The Pepper Wreck - Nossa Senhora dos Mártires, 1606: update on the virtual reconstruction of a Portuguese India nau*. XIV International Reunion for the History of Nautical Science, Coimbra, Portugal, October 23-25, 2008.

Castro, F., N. Fonseca and T. Santos. *"A reconstrução virtual de uma nau da Índia: uma hipótese de trabalho"*, Academia de Marinha, Lisbon, Portugal, October 2008.

Castro, F., *Computers and Shipwrecks: The Pepper Wreck Reconstruction as a Virtual Hypothesis* Emory University. Invited by Emory University's Department of Middle Eastern and South Asian Studies. April 15 2008.

Castro, F., N. Fonseca and T. Santos. *Estudo das características náuticas de uma nau de 600 tonéis da Carreira da India (paper delivered by Dr. Nuno Fonseca).* Academia de Marinha, Lisbon, Portugal, November 2007.

Castro, F., *Sailing the Pepper Wreck: A Virtual Reconstruction of a Portuguese Indiaman,* North East Florida Symposium on Underwater Archaeology, St. Augustine, Florida. March 20-22, 2007.

Communications at International Meetings

T. Santos, N. Fonseca, T. Vacas, and Castro, F. *Numerical Simulations of Indian Route Voyages by the Late 16th Century Portuguese Indiamen*, 43rd Annual Meeting of the Society for Historical Archaeology Annual Conference, Austin, Texas,

January 2011.

Fonseca, N. and Castro, F. *Experimental Archaeology with a Portuguese Indiaman Scaled Model*, 43rd Annual Meeting of the Society for Historical Archaeology Annual Conference, Austin, Texas, January 2011.

Fonseca, N., Figueiredo, M., T. Vacas and Castro F. *Projecto e construção de um modelo para testes da nau Nossa Senhora dos Mártires*, Encontro Nacional de Engenharia Naval. O Transporte Marítimo e Fluvial de Passageiros. Lisbon, March 5, 2009.

Fonseca, N., Vacas, T., Santos T. and Castro, F. Testing the Pepper Wreck Virtual Reconstruction, at the 41st Annual Meeting of the Society for Historical Archaeology Annual Conference, Toronto, Canada, January 2009.

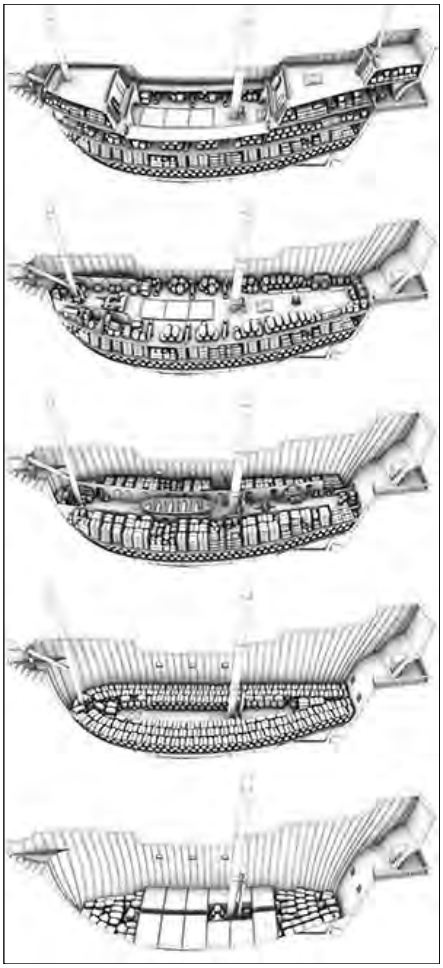
Castro, F., *Computers and Archaeology: a Look at the Watercraft of the Medieval Mediterranean*, at the Archaeological Institute of America Annual Conference, Philadelphia, January 2009.

Castro, F., *Computers and Archaeology. Virtual reality and the reconstruction a 17th century Portuguese Indiaman*, at the American Anthropological Association Annual Conference, San Francisco CA, November 2008.

Santos T., Fonseca N. and Castro, F. *Stability characteristics of an early XVII century Portuguese Nau*, 9th International Conference on Stability of Ships and Ocean Vehicles (STAB 2006), Rio de Janeiro, Brazil, 25-29 September 2006.[1]

Fonseca, N., Santos, T. and Castro, F. *Levantamento das características náuticas de uma Nau Quinhentista*, X Jornadas Técnicas de Eng. Naval. Inovação e Desenvolvimento nas Actividades Marítimas, Lisbon, 2006.[1]

Fonseca, N., Vacas, T. and Castro, F. *Análise das características náuticas de embarcações latinas medievais,*X Jornadas Técnicas de Eng. Naval. Inovação e Desenvolvimento nas Actividades Marítimas, Lisbon, 2006.[1]



Cargo Distribution aboard the Pepper Wreck at departure from India (Audrey Wells).

Castro, F., N. Fonseca and T. Santos. Study of the Intact Stability of a Portuguese *Nau* from the Early XVII Century, IMAM 2005 Conference: Maritime Transportation and Exploitation of Ocean and Coastal Resources. London, 2005.[1]

[1] *Paper Published*

Graduate Work

Audrey Wells, *Virtual Reconstruction of a 17th-Century Portuguese Nau* (MA 2004-2008 – Chair: Frederick Parke, Department of Visualization, Texas A&M University).

Kelby Rose, *A Three-Dimension Study and Reconstruction of Vasa* (PhD 2008-).

Charles Justus Cook, *A Parametric Model of the Portuguese Nau*. (MA 2010-2011 – Chair: Frederick Parke, Department of Visualization, Texas A&M University).

Kotaro Yamafune, *Tridimensional Reconstruction of a 17th Century Merchantman* (PhD 2012-).

Newsletter Articles

Castro, F., Fonseca, N., Vacas, T., Sauer, A., "Numerical Models and the Dynamic Interpretation and Reconstruction of Medieval and Early Modern Shipwrecks", *CMAC News and Reports*, (2009) 2.1: 1-3.

Alexander Hazlett

The Textual Excavation of an India Nau

2001-2007

Alexander's work is focused mainly upon the "textual excavation" of a nau of the Carreira da India (the "India Route"), describing the construction of the vessel timber by timber, following the methods of 16th-century shipbuilders and the dimensions and measurements specified in contracts and treatises. Using Rhinoceros 3 software to model the ship, he built the model directly from a list of timbers described in the anonymous manuscript Livro náutico ou meio pratico de construção de navios e galés antigas - Ms. F464 from the National Library, Lisbon, dated to 1580-1590 - which he translated and interpreted.

Although the primary source for this reconstruction was the regimento "Medidas pera fazer huma Nao di Seiscentas Tonilladas, e os paos que hà de levar de Sovoro e Pinho" from the *Livro Nautico*, Alexander used Fernando Oliveira's treatise *Livro da Fabrica das Naus (*c. 1580) extensively, and looked at numerous other original texts when it was necessary to understand a criptic passage or term in the *Livro Nautico*. Another text used was written around a decade later, was João Baptista Lavanha's treatise *Livro Primeiro de Arquitectura Naval*.

Data derived from these sources was compared to those found in other treatises, iconography, and the archaeological record. The reconstruction was based on a hypothesized construction sequence, mainly based on the order in which the timbers are presented in the *Livro Nautico* document. Neither the treatise of Oliveira nor that of Lavanha contradict this sequence of building operations.

Where they were missing, the scantlings of each type of component were estimated based on data from the archaeological record.

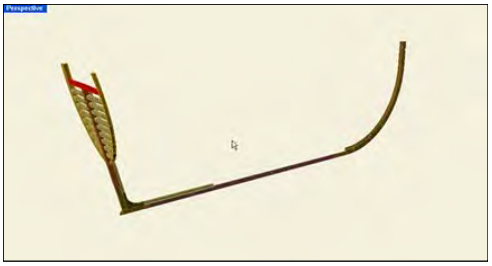
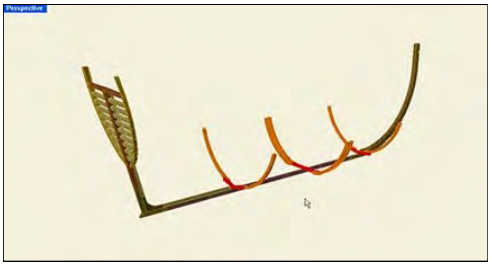
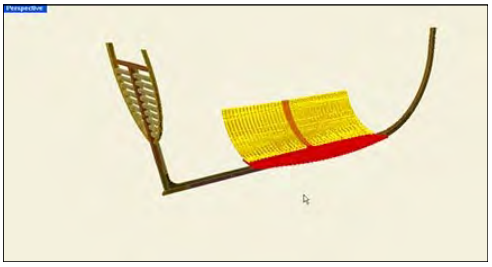
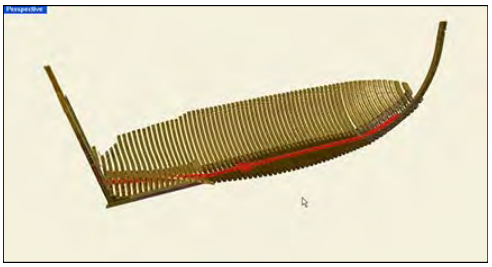
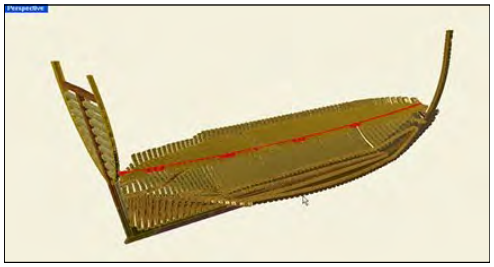
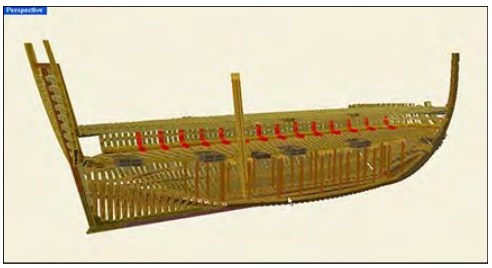
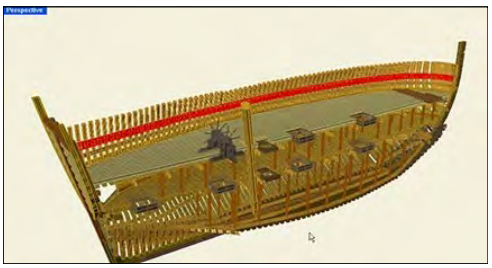
Shapes were defined using the geometrical formulas and other data contained in the ship treatises of the period, or found in the archaeological record.

A folio of the *Livro náutico* manuscript.

The model was defined using *Rhinoceros 3* three-dimensional modeling software. The end result of this project is an annotated model, illustrated by a 3-D model, presented on the next page.

Written around 25 years later than the vessel described in the *Livro Nautico,* and showing a larger vessel, the treatise of Manoel Fernandez - *Livro de Traças de Carpintaria*, 1616 - was very important to help decoding the meaning of certain timber names. Fernandez' drawings and scantling gages are a tremendous primary source for the understanding of Portuguese shipbuilding in the period.

One last source utilized was the Spanish treatise by Diego Garcia de Palacio, *Instrucion Nautica Intrvcion navthica para el bven vso, y regimiento de las Naos, su traça, y gouierno conforme à la altura de Mexico*, dated to 1587.

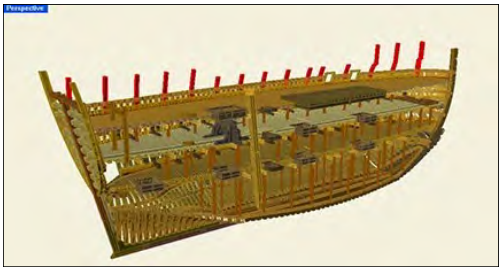
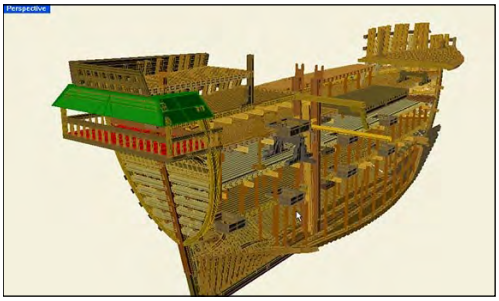
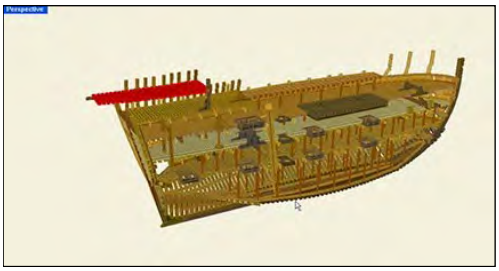
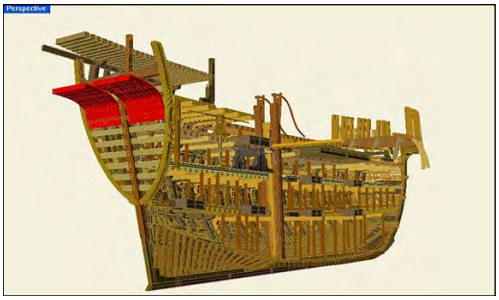
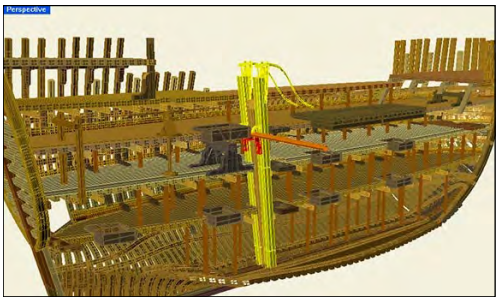








Each timber of the *Livro náutico ou meio pratico de construção de navios e galés antigas* regimento "Medidas pera fazer huma Nao di Seiscentas Tonilladas, e os paos que hà de levar de Sovoro e Pinho" was detailed, designed in 3D and assembled following the traditional methods, as prescribed in the coeval shipbuilding treatises.

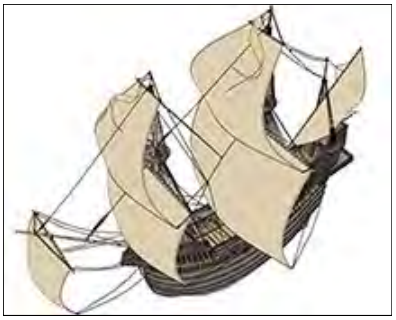
Because this text contains the number of timbers of each kind that are necessary to build a 600-ton *nau*, Alexander was capable of achieving an impressive level of detail, for instance in what pertains to the spaces between frames or deck beams.

These values were then compared to the available data from shipwrecks and other texts which greatly improved the plausibility of his reconstruction.

Alexander's model was later expanded and fine-tuned by Nuno Fonseca, Tomás Vacas, and Tiago Santos, the team from the *Centre for Marine Technology and Engineering , Instituto Superior Técnico* that tested the Pepper Wreck reconstruction with numerical and physical models, in order to evaluate its intact stability and its performance under sail.

Some of the many construction phases detailed by Alexander Hazlett in his seminal study of this type of construction.



Centre for Marine Technology and Engineering (CMTE), Instituto Superior Técnico.

Sailing the Pepper Wreck

2006-

This study was a collaborative project between the disciplines of nautical archaeology and naval engineering, and consists of a series of tests with the model of the 1606 Portuguese vessel Nossa Senhora dos Mártires, also known as the Pepper Wreck, developed in the ShipLAB between 2001 and 2006.

Based on the information retrieved from the Pepper Wreck's archaeological remains, compounded with almost a century of studies on iconography and contemporary written sources, both literary and technical, the main objectives of this project were:

a) To obtain a plausible configuration for the hull, masts, spars, rigging and sail plan of an India *nau*;

b) To try to understand the complexities of the construction sequence and structural details of these ships and determine their fundamental characteristics in terms of total weight, weight distribution, displacement and trim;

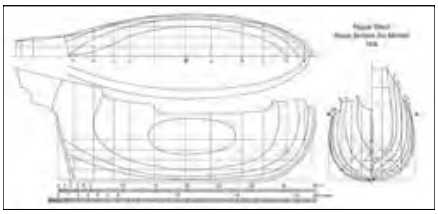
c) To assess their sailing abilities under different weather conditions, in terms of stability, propulsion force, resistance, performance, and maneuverability; and

d) To assess the ship's structural strength to extreme and fatigue loads.

To achieve these goals we established thirteen tasks:

T1 - Development of a set of hull lines, sail plan and rigging plan

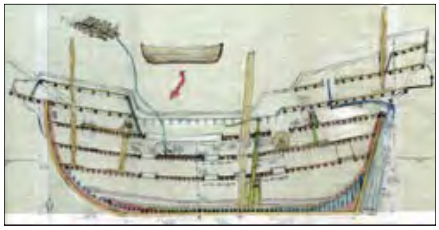
This task entailed an analysis and fine tuning of the existing lines drawings, and the development of the masts and spars plan, sail plan, and rigging plan. Several models were developed and discussed.



Lines drawings of the Pepper Wreck.

T2 - Design of the ship's structure, including space divisions and internal bulwarks

A three-dimensional model of the ship's structure was created based on the model developed by Alex Hazlett, as well as a theoretical internal subdivision of the spaces. The weights and centers of gravity of each timber piece were entered , using the different specific densities of the various kinds of timbers used. A definition of the interior spaces was developed to allow the estimation of the cargo capacity, weight, and distribution of the cargo and ballast for each loading configuration.

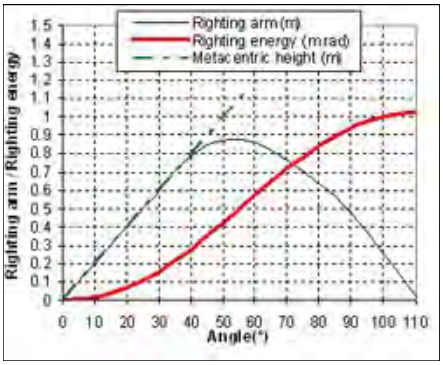


Sketch with the decks and internal division of spaces.

T3 - Stability analysis

This task comprised the assessment of the floatability and stability of the ship for several loading conditions.

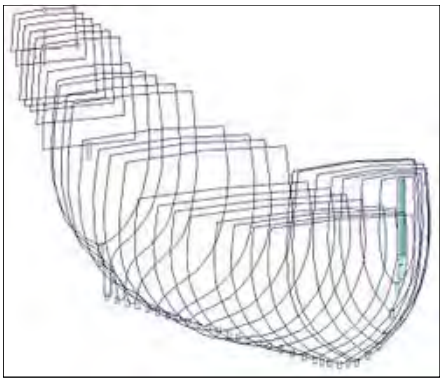
Firstly the intact stability was investigated by modern computational methods, including small-angle and large-angle stability. The results were then compared to current stability criteria for large sailing vessels,



Righting moment for a full hull.

allowing an estimation of the actual safety of the ship. We plan to investigate the stability during and after flooding (damaged stability), and to discuss the effectiveness of the crew countermeasures described in contemporary documents.

CMTE model of the Pepper Wreck.



T4 - Hydrodynamic model tests in towing and seakeeping tanks

This task entailed the construction of a 1/10 model for:

a) resistance tests, where the model was towed in still water at several speeds to measure the resistance to the advance;

b) sea-keeping tests, where the model will be towed in regular and irregular waves to measure the induced motions and added resistance to the advance due to the waves; and

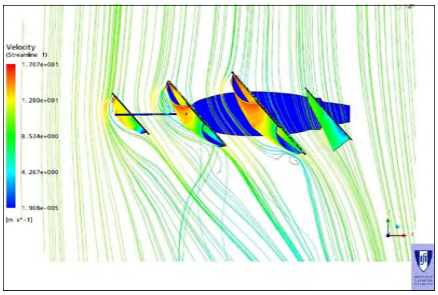
c) maneuvering tests where forced horizontal motions are imposed on the model to obtain the hull manoeuvering characteristics.

Tow tank essays.

T5 - Aerodynamic tests in wind tunnel with sail model

A model of the hull's upper works and rigging was built and will be tested in a wind-tunnel, with different wind conditions such as various wind directions.

These tests will be carried out considering only the sails (in several configurations) as well as the sails together with the hull's upper works, since it is known that the size of the fore and stern castles of these ships influenced their performance under sail.



Aerodynamic tests at CMTE.

The results will be used to calibrate the theoretical model built in task 6.

Model with the masts and yards.

Model with sails.

T6 - Calibration of the theoretical models for ship dynamics

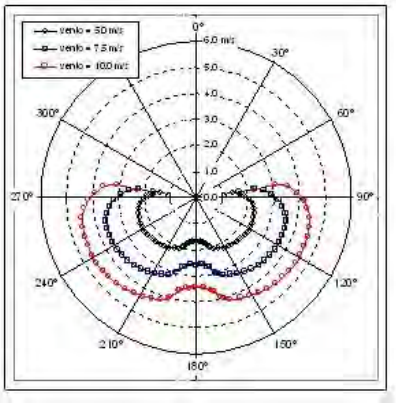
CMTE has developed and implemented software based on several theoretical models that calculate the dynamic behavior of ships at sea: resistance to advance, seakeeping in waves, maneuvering and sailing performance.

Numerical simulations of the reconstructed ship at CMTE.

However, these models are at present adequate for modern conventional ships and vessels. Those modern models will be calibrated and validated to represent the dynamics of the Pepper Wreck, by systematic comparison of results with tank and wind tunnel data.

T7 - Calculation of the Polar Diagram of Speeds

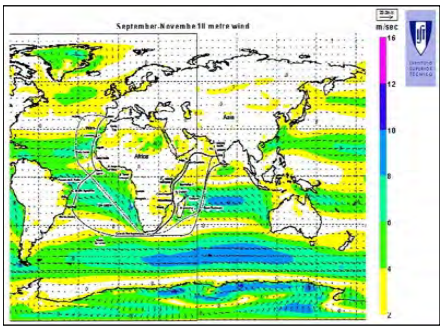
This task will consist of the calculation of the polar diagram of speeds, a graphic that indicates the speed attainable for each direction and wind force combination. In addition to the sailing speed and direction, UETN software will find the heeling, drift and rudder angles, while sailing in equilibrium for each situation of wind intensity and direction and sail configuration.



Polar diagram.

T8 - Assessment of the India Route various paths

Considering the patterns of wind and currents for the Atlantic and Indian Oceans during the periods in which these ships sailed from Europe to the Indian Subcontinent and back, an attempt will be made to simulate a full round voyage and determine the speeds and times traveled during each leg.

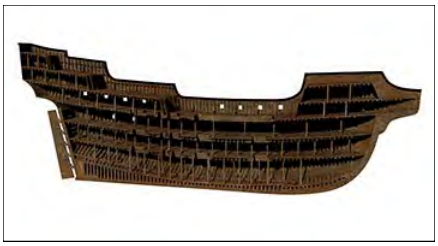


Winds and currents model.

A critical analysis will be performed in order to assess if the route chosen by the Portuguese pilots was in fact the best possible solution given the ship's characteristics and the calendar restrictions imposed upon the trips - a complex set of restrictions that were related with the harvest and cure of the peppercorns in India, the prevalent winds of each monsoon, and the pathway of the cash flows that fuelled the commerce.

T9 - Assessment of the ship's structural strength

The model built in tasks 1 and 2 will be used to study the structural strength of these ships. Almost nothing is known about this subject other than that the scarcity of suitable timber for shipbuilding that characterized this period made these ships very interesting subjects of study from the optimization-engineering point of view.



The wooden structure after Tomás Vacas and Alex Hazlett.

Structural loads imposed by severe weather, transmitted to the hull structure by both large waves and by the rigging will be analyzed and compared with the structural strength expected for the model, given the timber sections utilized, the types of connections, scarves, and fastening patterns.

Fatigue will also be analyzed since these ships were subjected to violent and repetitive stresses during long periods of time-frequently over one month-during their six to nine month's trip. One of the most interesting aspects of this study will be to assess the influence of heterogeneity of the timber, as a construction material, in the final strength of the ship.

A computer model based on Alex Hazlett's was developed by CMTE student Tomás Vacas (Rhinocerous®).

T10 - Creation of a virtual reality model

A three-dimensional virtual model was designed by Texas A&M VizLAB student Audrey Wells(Autodesk Maya®) to provide both the investigators and the target public a better understanding of the interior space distribution, living conditions, sailing performance and maneuvering.

Audrey Wells model.

This model allows the representation of spaces and environments of indubitable interest, both for the scientist's under-

standing of the ship under study, and for the public targeted in the dissemination of the study's results.

T11 - Virtual Reality Simulations

We expect to develop this model further and use it together with the mathematical models to recreate a series of typical situations routinely encountered by an India nau, such as: maneuvering, including reaching, beating, changing tack, stopping; the dynamics of the ship under several different sailing conditions; the inflow of water which might result in sinking, including the measures taken by the crew; simulation of the construction process; the operation of launching; simulation of the careening of the ship.

T12 - Construction of a scale model

This task consists on the construction of a wooden scale model of an India *nau*. These models permit a better understanding of the ship shape and structure, based on the restrictions of the building materials.

Carlos Montalvão's wooden model.

Models allow scientists to understand the real possibilities of the timber utilized, the most important aspect being the simulation of bending directions of the wales, stringers, planking strakes, and the influence of this practical knowledge - today completely lost - on the conception and design of these ships. Each construction phase is being documented in video and digital photography.

T13 - Dissemination of the results

The objective is the dissemination of the results to two main target publics: the scientific community and high school teachers and students.

The test model in a simulated situation.

This task encompasses the publication of articles in academic journals, in magazines aimed at a wider public, the production of short videos for the internet, and an attempt to generalize the use of the VizLAB immersion software C.A.V.E.

This project has created numerous opportunities to develop a better understanding of the design and construction of the ships that opened the Asian markets to Europe.

Inspecting the ship's interior space at the C.A.V.E.

Publications

A complete list of our publications is presented on pages 58-62, included in the Pepper Wreck Project.

Audrey Wells

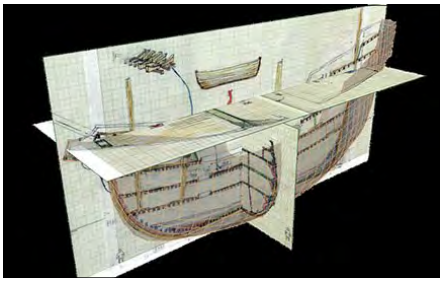
Modeling the Pepper Wreck

Chair: Frederick Parke, VizLAB

2004-2008

This study was a collaborative project between the fields of nautical archaeology and computer visualization. An interactive virtual reconstruction of the 1606 Portuguese vessel Nossa Senhora dos Mártires, also known as the Pepper Wreck, was developed as a detailed 3D computer model based upon reconstruction information gathered from the shipwreck site and a number of contemporary texts and images. The model of the ship was displayed within an appropriate virtual environment. Models of cargo and people were added to show how the ship might have appeared loaded with trade goods and hundreds of crew and passengers on the return voyage from India. The scene was shaded and lighted. Both the internal and external structures of the ship can be navigated using an interactive interface.

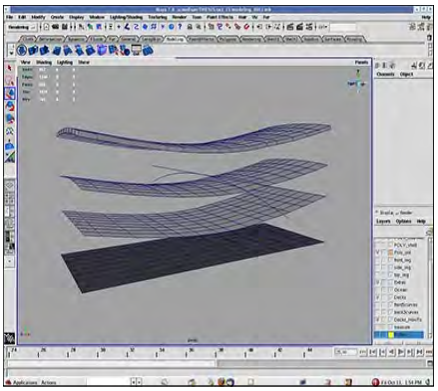
In Audrey's own words: "Modeling is a very powerful tool, which can allow viewers to progress from what is observable, archaeological data and theory, to concepts of what is unobservable, the past."



Audry Wells preliminary study for the Pepper Wreck Model.

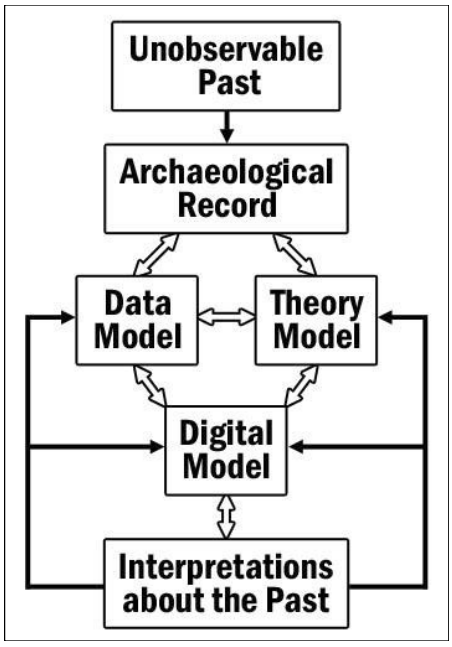
Quoting Gary Lock's Using *Computers in Archaeology: Towards Virtual Pasts* (London: Routledge, 2003), Audrey continues: "'Moving from data to explanation through theory and interpretation has always been the endeavor of archaeology.'

Lock also presents the use of computer modeling in archaeology as a *hermeneutic spiral*, or process of interpretation, in which the data model and theoretical model are derived from the archaeological record through interpretation. Digital computer models, informed by the data and theory, add an additional layer of interpretation.



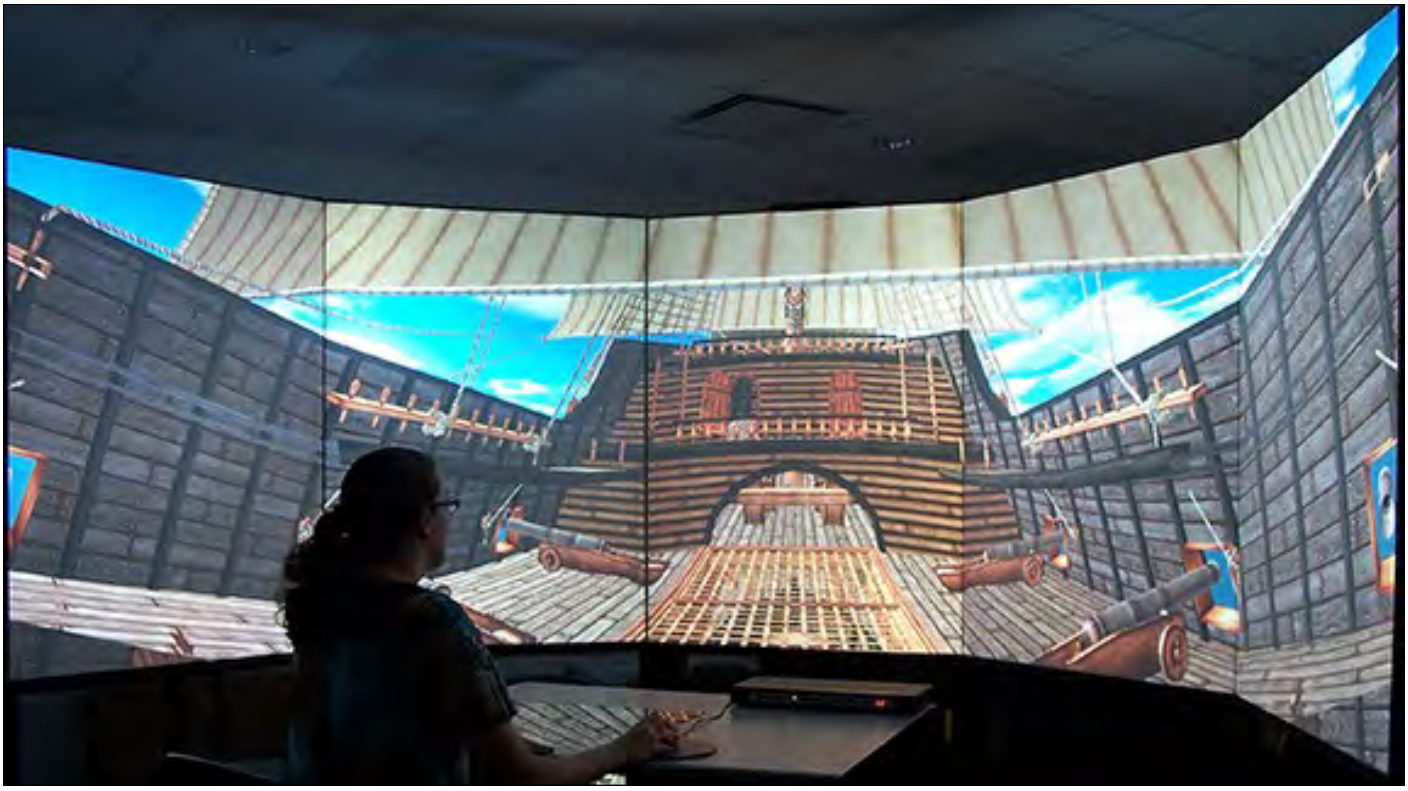
Autodesk Maya proved to be an extremely useful tool to model the complex curvatures of a ship's hull.

Based on the models, interpretive statements about the past are made. These interpretations constantly inform and reform our understanding of the past. (…) This is useful because the subject of study is generally from partial remains. Models, and the process to create them, can have a significant influence on archaeological interpretations. Gary Lock asserts: 'Because the past is complex, often unknowable and unverifiable, working through models is the only way of approaching explanation and experimenting with the meaning of observed data.'"



Based on Gary Lock's work, Audrey's interpretive cycle using computer models in archaeology. The white outlined arrows indicate interpretations made during the process.

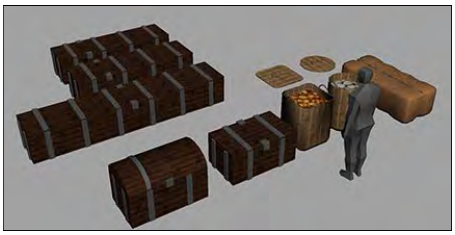
Audrey's model is the basis for further work.



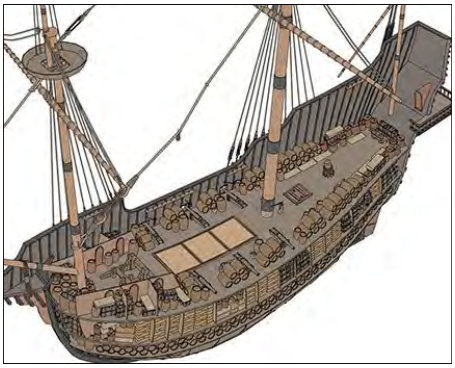
Testing the model at Frederick Park's C.A.V.E.

Crew and passengers were modeled after Italian 16th Century painter Luca Cambiaso, whose stylized figures revealed themselves extremely economic in term of computer memory allocated per person.

Reconstruction of the mainmast top, stay, shrouds, and lifts.



The cargo was object of careful study and all clues to standardization retrieved from coeval documents were used.

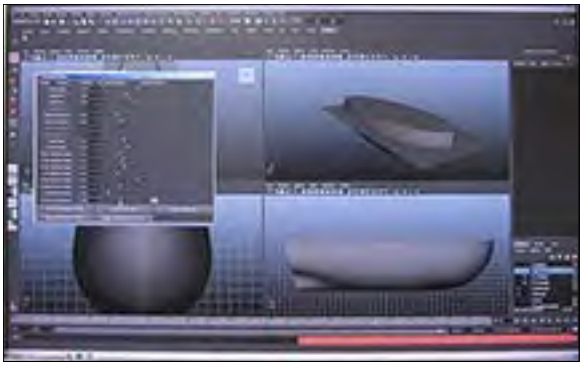


The Pepper Wreck reconstructed and loaded, at departure from Cochin, India, to Lisbon, Portugal.

Barrels turned up to be very difficult to model, at least in what pertains to their standardized sizes. We have their capacities, but not their main dimensions..

Asian pots, common in shipwrecks from this period.

Audrey's work was further developed by Kotaro Yamafune, who focused on the rigging and the immense task of inserting the crew and passengers.



Charles Justus Cook

A Parametric Model of the India Naus

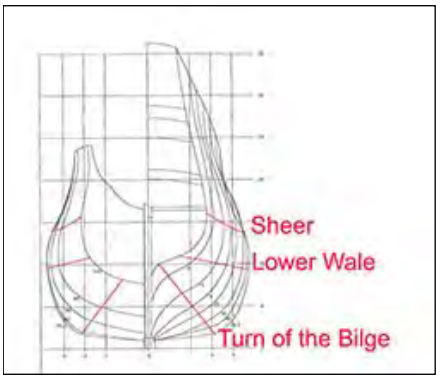
Chair: Frederick Parke, VizLAB

2010-2011

This interdisciplinary project combined the disciplines of nautical archaeology and computer visualization in order to create an interactive virtual reconstruction of a Portuguese nau. Information about the shipbuilding process was gathered from 16th and 17th century treatises by Fernando Oliveira and João Batista Lavanha . Eight registered tonnage formulas from the 16th and 17th centuries were used to estimate the cargo capacity of the reconstructed hulls. Using this information Justus Cook developed an algorithm that creates a parametric computer model of a hull and calculates its registered tonnage. This parametric model allows the user to choose between the Oliveira and Lavanha conception recipes, adjust the basic dimensions of a ship's hull (e.g. keel length, beam, depth of hold) to fine-tune the hull shape further, and save the information about the hull shape for future editing. The eight registered tonnage estimates are compared to the volume of the parametric hull model below a generic waterline.

Ship shapes are relatively easy to define through a small number of more or less complex curves:

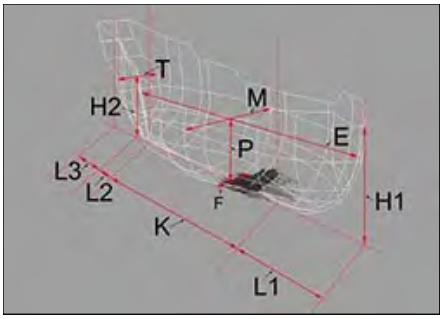
1. The curve defined by the sternpost, keel and stem post;
2. The turn of the bilge curve;
3. The lower whale curve;
4. The sheer line.



Basic curves in the generation of hull shape.

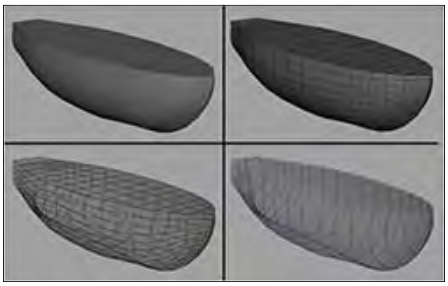
In a significant paper entitled "Shape Creation in Civil and Naval Architecture" (Nowaki and Lefèvre, eds., *Creating Shapes in Civil and Naval Architecture*. Leiden: Brill, 2009: 3 -45) Horst Nowaki argues that the evolution of ship shape can be analyzed along three axis:

1. The time axis;
2. The geometric complexity axis;
3. The axis of tools and methods of shape creation.



Basic measurements defining a ship hull.

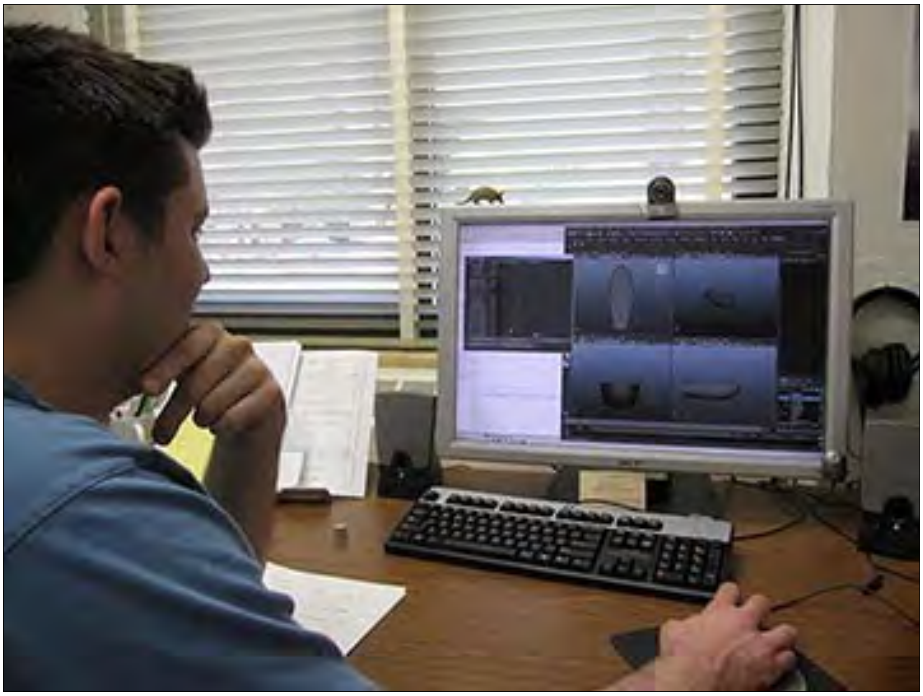
In this particular study Justus was asked to take in consideration only the axis of geometric complexity. For the relatively short period under analysis the tools and methods used by shipwrights to generate shapes were limited and common to the entire region considered (Europe).



Hull shapes generated following one of the construction recipes in the shipbuilding treatises considered in this study (Fernando Oliveira and João Lavanha.

The shapes under study – the lower hulls of merchant and warships of the sixteenth and early seventeenth centuries – are relatively easy to model using differential geometry, namely applying the concept of Gaussian curvature.

One day we expect to use Paul de Casteljau / Piêrre Bezier's algorithms / curves and explore this subject further, but at this



Justus' model was developed in Autodesk Maya. Hull coefficients, displacements and capacities calculated from eight different formulas were computed separately and displayed in a spreadsheet for comparison purposes.

time we focused on a more immediate problem: to indentify and map the knowledge gaps encountered when we try to model three basic hull types: caravels, galleons and *naus*, namely in what pertains to the ranges of variations in length, beam, and depth of hold within each type, and within a period of around 150 years (1500-1650).

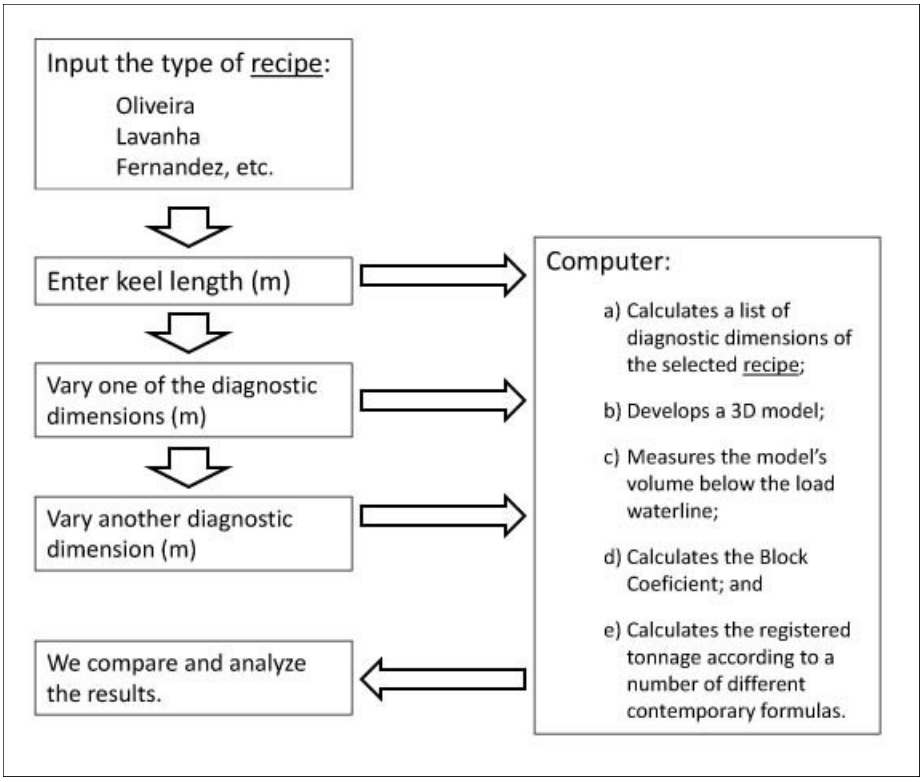
Understanding rated capacity and displacement becomes the first step in such a project. Different countries rated their vessels in terms of capacity based on different units and methods. After 1530 several formulas were adopted to determine a ship's freight capacity.

There are few studies relating different units, formulas, and functions, in a way that allows meaningful comparisons between, for example, a ship of 300 *tons* in England, circa 1550, and a nao of 300 *toneladas* in Spain, in the same year.

We have, however, a rather extensive list of basic dimensions of European oceangoing ships from this period that would be very interesting to compare.

Based on these data, this project followed the steps indicated on the fluxogram below and tried to understand the ranges of values expected for a number of parameters, such as hull coefficients, displacements, and designated capacities for a small sample of ships for which we have building contracts or other documents mentioning basic dimensions.

The results obtained suggest a fairly predictive set of variations in shape and size throughout the period under study, but only further research will allow us to draw definitive conclusions.


Input the type of recipe:
Oliveira
Lavanha
Fernandez, etc.
Enter keel length (m)
Vary one of the diagnostic dimensions (m)
Vary another diagnostic dimension (m)
We compare and analyze the results.
Computer:
a) Calculates a list of diagnostic dimensions of the selected recipe;
b) Develops a 3D model;
c) Measures the model's volume below the load waterline;
d) Calculates the Block Coeficient; and
e) Calculates the registered tonnage according to a number of different contemporary formulas.

Kelby Rose

The Reverse Naval Architecture of *Vasa*, a 17th-Century Swedish Warship

2008-

On August 10th, 1628 the Swedish warship Vasa set its sails for the first time, in Stockholm harbor. Its construction was personally commissioned by King of Sweden Gustav II Adolf and with its full complement of 64 cannon, the ship was the most powerful weapon in the world. After sailing less than one nautical mile, however, Vasa heeled precariously to port, plunging its lowest open gunports underwater. The massive warship filled with water and sank rapidly.

Research

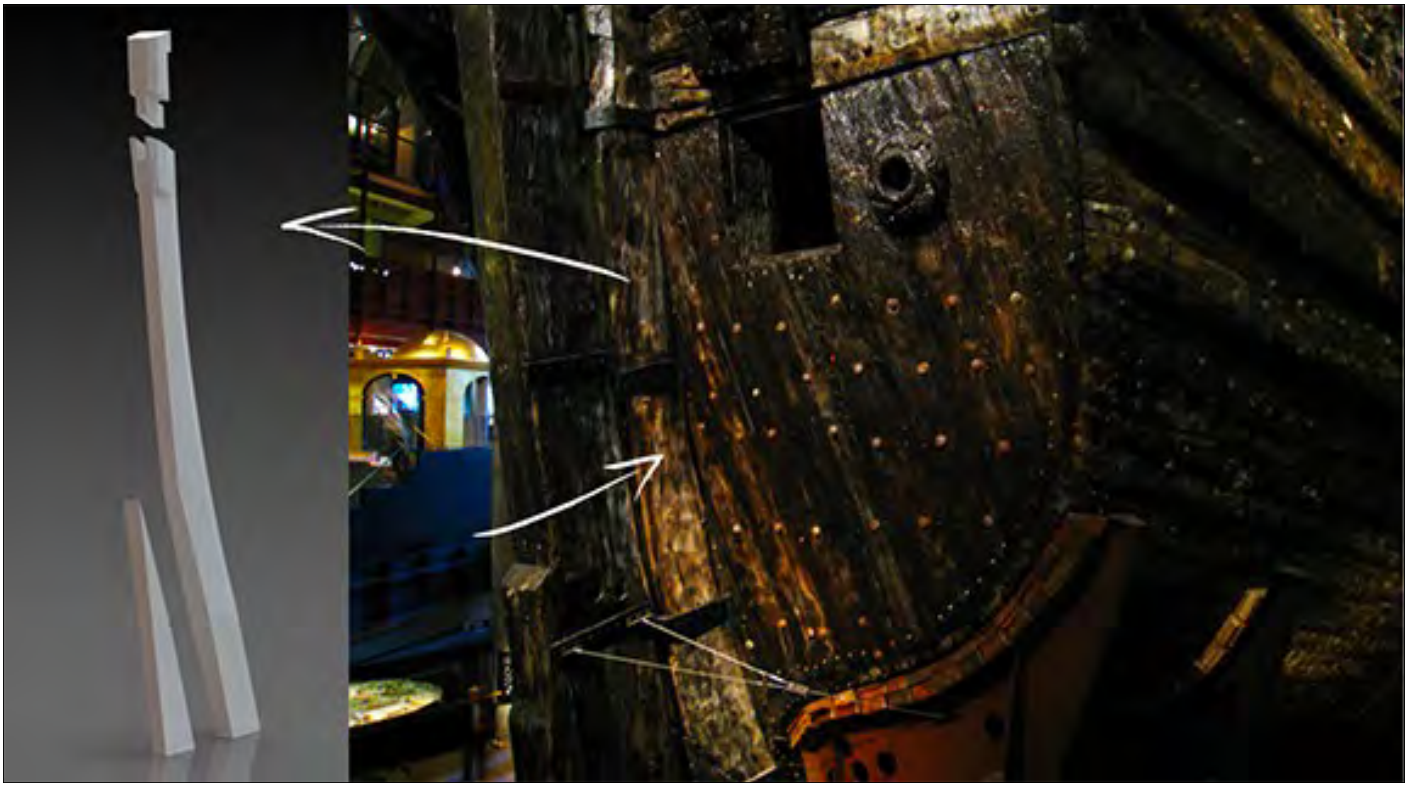
Vasa remained on the bottom of Stockholm harbor for 333 years, until it was raised nearly intact in 1961. It remains the oldest intact vessel ever recovered. After more than two decades of conservation treatment, *Vasa* went on display in a purpose-built museum in 1990. The hull and its associated artifacts have been the focus of intense archaeological investigations since the time of its raising, yet many fundamental questions remain unanswered about the ship. Kelby Rose's dissertation project seeks to answer one of these questions:

How was the hull of Vasa was designed?

In the early 17th century, the Dutch were famed as the premier shipbuilders in Europe and employed in several countries outside of the Dutch Republic. Two Dutch master shipwrights, Henrik Hybertsson and Henrik Jacobsson, oversaw the design and construction of *Vasa*'s hull. Construction features of the hull confirm that the ship was built according to 17th-century Northern Dutch methods of naval architecture. This is particularly significant as **Dutch shipwrights did not design their vessels on paper** prior to construction – instead they designed their vessels by eye. It is certain, however, that a deliberate mental design method was used, just not committed to paper. Literary and archaeological sources indicate that these methods were guided by a small set of rules of thumb. These rules, however, were frequently broken and do not account for every aspect of a ship's design. The experience and judgment of the shipwright filled in these gaps and allowed for complete design realization. *Vasa* presents archaeologists with an unprecedented opportunity to examine this process for an intact 17th-century vessel.

Using advanced digital 3D modeling technology, this disserta-

Vasa bottom planking (Kelby Rose)



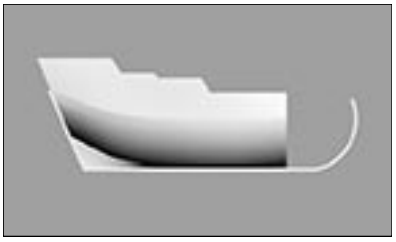
The sternpost of Vasa (Kelby Rose).

tion project is virtually deconstructing the hull of *Vasa* to recover and analyze the underlying system of logic that explains its design.

The stem post assembly (Kelby Rose.

This project is an important methodological step forward for the practice of nautical archaeology. Using *SolidWorks* 3D modeling software, Kelby Rose is constructing precise models of the principal components of *Vasa*'s hull. Due to concerns about its structural integrity, the actual hull of *Vasa* cannot be fully disassembled. The digital models however can be fully manipulated and therefore enable a level of analysis and interpretation that is not possible with their physical counterparts. These models will serve as the basis for a detailed 3-dimensional examination of the naval architectural principles of *Vasa* and recovery of its design method. This process of recovering the design concept from the intact structure is termed "reverse naval architecture". The highly visual nature of digital 3D models means that both the procedure and results of this project will be documented and disseminated in unparalleled clarity and detail.

The results of this dissertation project will not only answer fundamental questions about *Vasa* and the influential Dutch shipbuilding tradition during the birth of the Scientific Revolution, it will also contribute significantly to the array of analytical and visualization tools available to nautical archaeologists in the 21st century.



José Luis Casabán

Nuestra Señora del Juncal, México

2012 -

The aim of this project is to attempt the reconstruction of the Spanish galleon Nuestra Señora del Juncal based on primary written sources, archaeological data, and iconographic evidence, and gain a better understanding of 17th century Spanish galleons' design, construction, displacement, hydrodynamic properties, and outfitting.

Nuestra Señora del Juncal was built in 1622 at Fuenterrabía (Guipúzcoa, Spain) following the 1618 *Ordenanzas* (shipbuilding ordinances), issued during the reign of Phillip III to regulate and standardize naval construction. The ship was probably designed as a merchant galleon since it was privately built. Once completed, it travelled as a merchant vessel to Veracruz, Mexico, as part of the New Spain Fleet in 1625. After its return voyage it remained docked at Cádiz until it was confiscated in 1629 to serve as *capitana* (flagship) of the 1630 fleet of New Spain (Mexico).

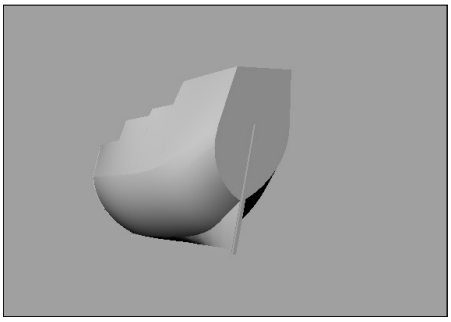
During its second voyage the ship stayed in Veracruz until October 1631, when it departed for Havana as the fleet *almiranta* (vice-flagship). During the journey to Havana, the galleon was caught in a storm and badly damaged. The situation was so dramatic after one week that the main mast had to be cut to keep the ship's stability. Moreover, artillery (the ship was carrying 24 cannons that weighed almost 33 tons), chests, old rigging and other objects were jettisoned in a desperate attempt to keep the ship afloat. Notwithstanding, in the night of the 31st of October 1631, the ship rolled to its starboard side and pitched from the bow, raising the stern and sinking very quickly. Three-hundred and eleven people were lost, as well as the ship's cargo. Only thirty-nine people survived

Detail of "The recovery of Bahia in 1625," by Juan Bautista Maíno, 1634/5. Museo Nacional del Prado.

The reconstruction of *Nuestra Señora del Juncal* combines the original measurements of the galleon, as provided by contemporary documents, and the 1618 *Ordenanzas,* in order to produce a reasonable scantling list as well as the masts and yards dimensions. However, the *Juncal* was modified and repaired several times before and after being designated as the *capitana* of the New Spain Fleet. In 1625, its hull was doubled (*embonado*) in Veracruz, probably to correct some stability deficiencies of the original ship's design. Contemporary documents also mention other modifications intended to reinforce the hull of the ship, both to carry artillery and to improve the ship's seaworthiness and cargo capacity.

Detail of "The recovery of the Island of San Cristóbal," by Felix Castello, 1634. Museo Nacional del Prado.

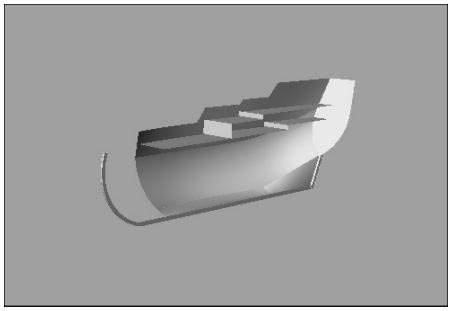
In order to understand and incorporate these modifications in the reconstruction, contemporary Iberian shipbuilding treatises and contracts are being examined. The dimensional data provided by the scantling lists is combined with the design methods of the 17th century using a CAD software



View of he 3D model being developed at the ShipLAB (José Luis Casaban).

package to produce the line drawings of the galleon. A full three-dimensional model with the hull components and the complete sail plan of the galleon is also being constructed. Finally, the cargo, crew, passengers, gear, rigging, anchors, ordnance, and ballast will be added to the model.

Once the three dimensional model is created, its displacement will be calculated and correlated with the sixteenth and seventeenth century tonnage formulas. The volume of the galleon's scantlings will be multiplied by the weight of the different types of wood used in their construction, which are usually specified in the construction contracts. The combined weight of fastenings and fittings will also be included in the previous number. Then, the weight of the cargo, gear, rig, anchors, ballast, stores, ordnance, passengers, and crew will be incorporated in the model to calculate the total displacement of the galleon. Finally, the proportions and hydrodynamic properties of the galleon will be calculated, including the ship's principal dimensions (lengths, breadths, and depths), length/beam ratio, waterplane area and coefficient, midship, block and prismatic coefficients.



Another aspect of the 3D model being developed at the ShipLAB (José Luis

The results of the calculations may be used to perform an accurate comparison between the silver galleons and similar types of ships built during the same period by other European maritime powers. This analysis will help to introduce some objectivity to this type of comparisons, which are often based on nationalistic essays supported by erroneous or partial hypothesis.

The final objective of the reconstruction is to become a dynamic model which can be implemented with the data provided by new studies and archaeological projects. In the same way, the model intends to provide a reasonable representation of *Nuestra Señora del Juncal* based on archaeological and historical research.

Kotaro Yamafune

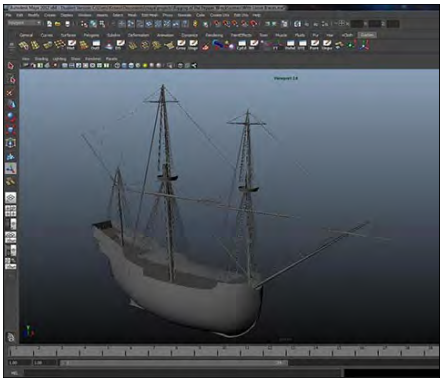
Modeling the Pepper Wreck...

2012-

The aim of this project is to reconstruct a 3D model of a 17th century Portuguese Merchantman based on both the archaeological data and historical documents, such as contemporary shipwright treatises, journals, and iconography. During the last decade, the quality and availability of 3D software has opened up new avenues of research in nautical archaeology. Commercial and over the counter software allows researchers to model and test their hypotheses about the complex spaces that form the interior of a ship.

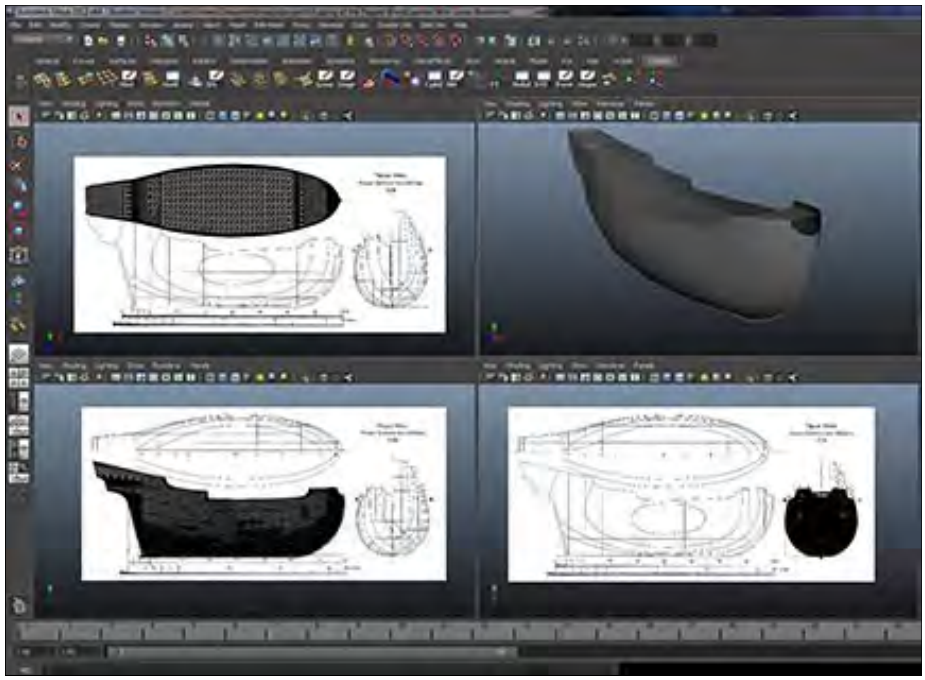
Three-D software permits a quick and relatively easy implementation of changes, corrections, as well as the testing of hypotheses generated from unclear written sources, both textual and iconographic. Moreover, high-end reconstructions of archaeological ships are effective tools to discuss and improve knowledge about shipbuilding, both at scholarly and popular levels.

I will attempt a full scholarly reconstruction of a large oceangoing ship based on the research developed in the Ship Reconstruction Laboratory from the data retrieved from the Pepper Wreck, an early 17th century Portuguese Indiaman lost near Lisbon on its return voyage from India. It has been tentatively identified as *Nossa Senhora dos Mártires*, lost in 1606. Although its authors admit that theirs is just a conjectural reconstruction,



The hull, masts and spars ready (Kotaro Yamafune).

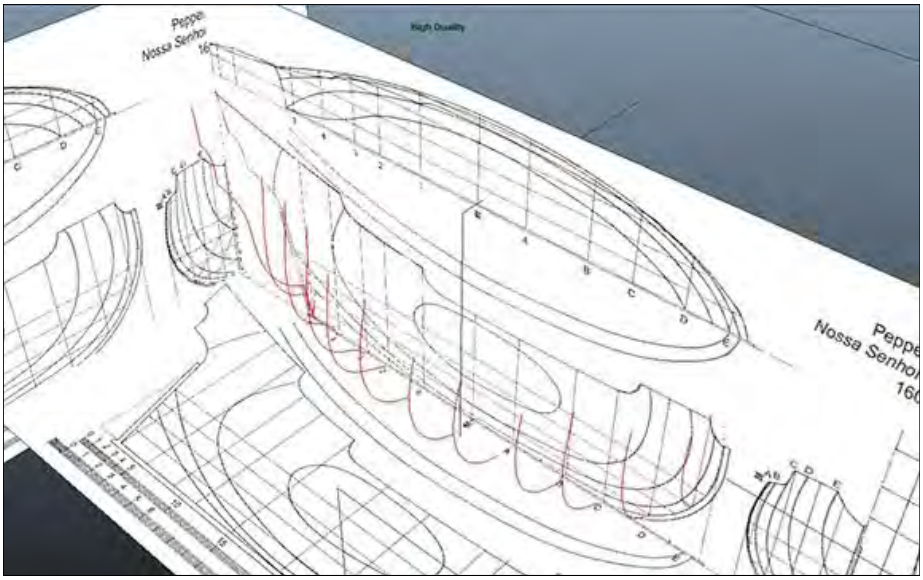
based on scarce archaeological remains, I have chosen this shipwreck because of the amount of data available about its conception, construction sequence, hull structure, rigging arrangement, crew, passengers, victuals, and cargo.



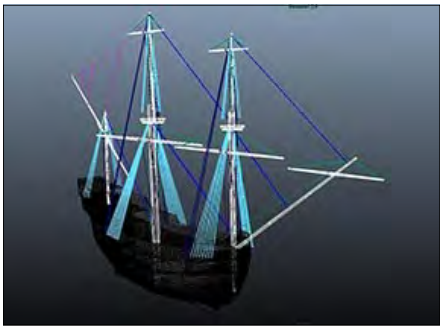
The design of the Pepper Wreck hull in Autodesk MAYA (Kotaro Yamafune).

I plan to create a visualized anatomy of a late 16th or early 17th century Portuguese merchantman for both scholars and the general public, using archaeological and historical data. To achieve this goal my reconstruction of the ship shall be composed of the ship hull, rigging, cargo, as well as aspects of life on board, such as the space appropriation by crew and passengers.

The cooperation between the



Set of lines used to model this version of the reconstructed Pepper Wreck (Kotaro Yamafune).



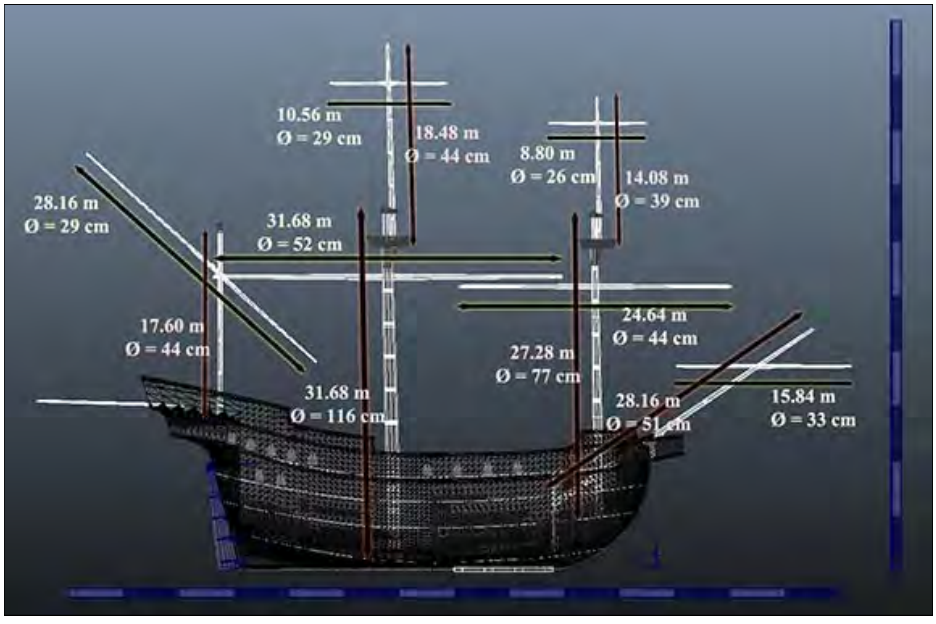
Masts, yards, and Standing rigging (Kotaro Yamafune).

Nautical Archaeology Program and the Department of Visualization (Vizlab) dates back to the mid-1990s, when the computer animation students developed models of the War of 1812 brig *Eagle*, reconstructed by Dr. Kevin Crisman, and the Dutch inland vessel Oost Flevoland B 71, dating to c. 1600 and reconstructed by Dr. Fred Hocker.

During the last decade the ShipLAB collaborated on another two projects with the Vizlab. The first consisted of a reconstruction of the interior volume of the Pepper Wreck (Audrey Wells) and the arrangement of the cargo and victuals, while the second explored the relations between the registered capacity and displacement in a 16th century Iberian merchantmen (Justus Cook). Both projects were oriented by Dr. Frederick Parke and Dr. Filipe Castro, and both have successfully demonstrated the enormous potential of the cooperation between the Vizlab and the Ship Reconstruction Laboratory.

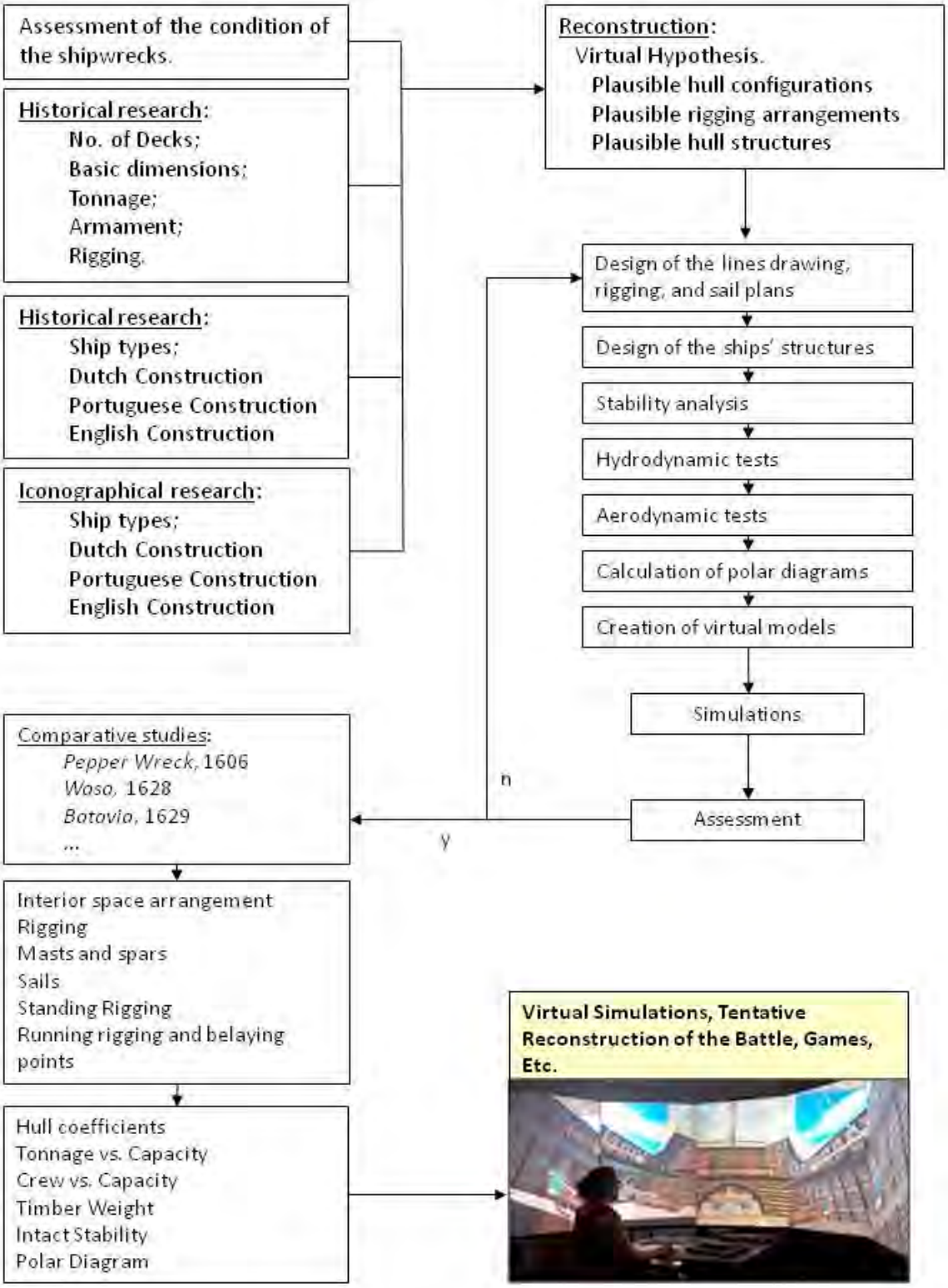
A third project, Kelby Rose's reconstruction of *Vasa*, is now in progress and this project will be framed within the same theoretical lines using 3D software to develop a model of the Pepper Wreck. This model will synthesize all the present knowledge about this ship, summarize the most important remaining questions regarding its reconstruction, and present the data in a clear and easy to use way to both the scholarly and the general public.

Yet another project using computer graphics as a tool to better understand the conception and construction of a ship is being developed by José Luis Casaban, and is a study of the Spanish almiranta *Nuestra Senora del Juncal*, lost off the coast of Mexico in 1631.



Dimensions of masts and spars. Kotaro Yamafune proposal.

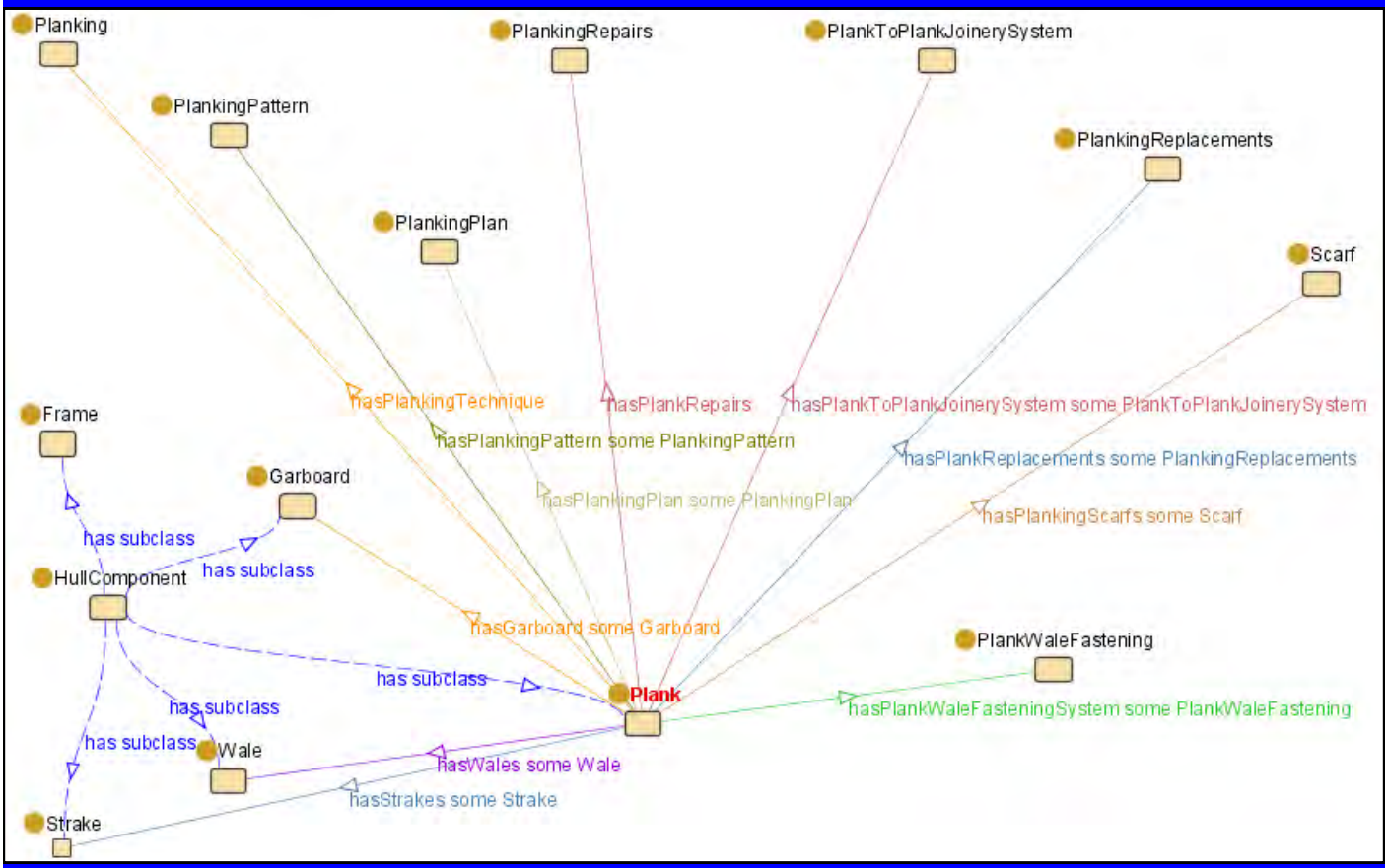
Computer modeling and 3D reconstructions allows us to establish a methodology to reconstruct and interpret shipwreck remains more accurately, and share our reasoning and primary data with our peers.



Computer Science

Featured

Projects



Computer Science

2005 -

In Cooperation with the Center for the Study of Digital Libraries

Our cooperation with the Center for the Study of Digital Libraries, a leader in the digital humanities field worldwide, has extraordinarily widened the ShipLAB research capacity and created opportunities for our students to dream about subjects such as the future of maritime archaeology and the data it generates, but above all, to think about what it means to be a maritime archaeologist in the digital age.

Publications

Monroy, C., Castro, F., and Furuta, R., "Synthesizing and Storing Maritime Archaeological Data for Assisting in Ship Reconstruction", in A. Catsambis, B. Ford and D. Hamilton, eds., *Oxford Handbook of Maritime Archaeology*, Oxford: Oxford University Press, 2011: 327-346.

Monroy, C., Furuta, R., and Castro F., "Using an Ontology and a Multilingual Glossary for Enhancing the Nautical Archaeology Digital Library". *Joint Conference on Digital Libraries JCDL*, Queensland, Australia, 2010, pp. 259-262.

Monroy, C., Furuta, R., and Castro F., "Ask Not What Your Text Can do For You. Ask What You Can do For Your Text (a Dictionary's perspective)" *Digital Humanities 2009,* College Park: University of Maryland, 2009: 344-347.

Monroy, C., Furuta, R., and Castro, F., "Design of a Computer-based Frame to Store, Manage, and Divulge Information from Underwater Archaeological Excavations: the Pepper Wreck Case," in Castro, F. and Custer, K., eds., *Edge of Empire. Proceedings of the Symposium held at the 2006 Society for Historical Archaeology Annual Meeting, Sacramento, California*, Lisbon: Caleidoscópio, 2008.

Monroy, C., Furuta, R., and Castro, F., "A Multilingual Approach to Technical Manuscripts: 16th and 17th-century Portuguese Shipbuilding Treatises," Edie Rasmussen (Chair) *Proceedings of ACM/IEEE Joint Conference on Digital Libraries*, Vancouver, BC, Canada, 2007: 413-414.

Monroy, C., Furuta, R., and Castro F., Poster: "Ancient

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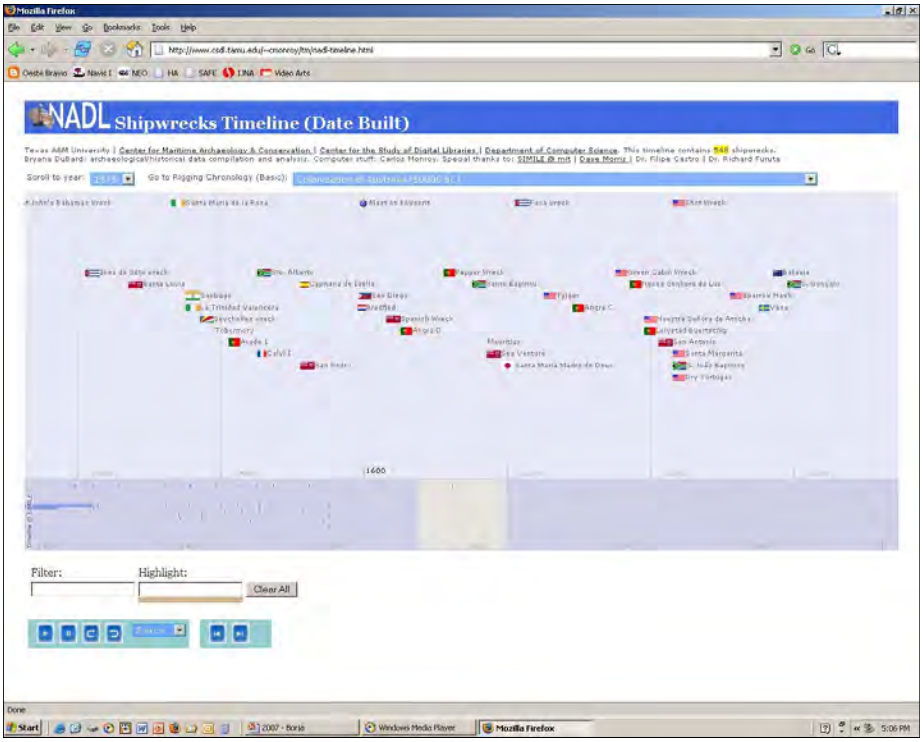
Facsimile not available due to the fascist attitude of the Director of the Leiden University Library
The slackers hired by Dr. Castro have not yet produced a serious transcription of this text.

Screen of the nautical Archaeology Digital Library (Carlos Monroy).



Timeline screen of the nautical Archaeology Digital Library (Carlos Monroy).

Technical Manuscripts: the Case of 17th-century Portuguese Shipbuilding Treatises." Schmit et al. (eds.) *Digital Humanities 2007 Conference Proceedings*. University of Illinois, Urbana-Champagne, June 4-7, 2007: 67-69.

Monroy, C., Furuta, R., and Castro F., "Texts, Illustrations, and Physical Objects: The Case of Ancient Shipbuilding Treatises." *11th European Conference on Research and Advanced Technology for Digital Libraries ECDL*, Budapest, Hungary, 2007.

Monroy, C., Parks, N., Furuta, R., and Castro, F., Poster: "The Nautical Archaeology Digital Library," in Gonzalo et al. (Eds.), *European Conference on Digital Libraries 2006 LNCS 4172* :544-547, Berlin and Heidelberg: Springer-Verlag, 2006.

Communications at International Meetings

Monroy, C., Furuta, R. and Castro, F. *Digital Integration of Shipbuilding Treatises and Ship Fragments in the Reconstruction of Ancient Sunken Ships*, at the 39th Annual Meeting of the Society for Historical Archaeology

Screen of the nautical Archaeology Digital Library (Carlos Monroy).

Annual Conference, Williamsburg, VA, January 2007.

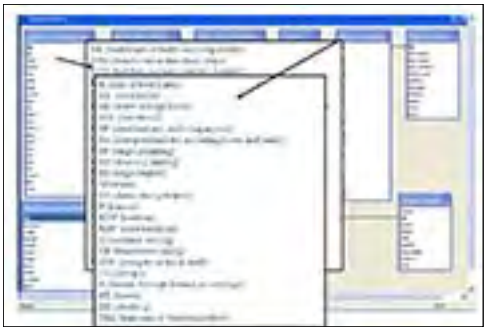
Monroy, C., Furuta, R. and Castro, F. *Design of a Computer-based Frame to Store, Manage, and Divulge Information from Underwater Archaeological Excavations: the Pepper Wreck Case* 38thSociety for Historical Archaeology Annual Meeting, Sacramento, California, 2006.

Graduate Work

Carlos Monroy, *The Nautical Archaeology Digital Library* (PhD 2005-2009 – Chair: Richard Furuta, Department of Computer Science, Texas A&M University).

Newsletter Articles

Castro, F. and Furuta R., "Nautical Archaeology Digital Library," *INA Quarterly* (2006) 33.4: 20-22.



Carlos Monroy

Nautical Archaeology Digital Library

2005-2008

NSF Grant IIS-0534314

The objective of this project was to design, implement, and evaluate a framework that would a) efficiently catalog, store, and manage artifacts and ship remains along with its associated data and information produced by an underwater archeological excavation; b) integrate heterogeneous data sources from different media to facilitate research work; c) incorporate historic sources to help with the study of current artifacts, d) develop visualization tools to help researchers manipulate, observe, study, and analyze artifacts and their relationships; and e) develop algorithm and visualization based mechanisms for ship reconstruction, i.e. to determine where recovered pieces and fragments fit in a whole. Our objective was to make the findings and information acquired available over the Internet to scholars as well as to the general public. The project focused on a specific excavation site; the Pepper Wreck.

From the Computer Science viewpoint, the major impact areas of this project were within the specialty area of Digital Libraries and included:

a) A flexible cross-linking of heterogeneous content in a dynamically-growing collection;

b) A flexible use of annotations to enhance community access while respecting individual information rights;

c) A focus on incorporating uncertain data;

d) Advances in the digital library replication and synchronization; and

e) General applications of visualizations based on 2D grids.

From the Nautical Archaeology viewpoint, the major impacts of the project were:

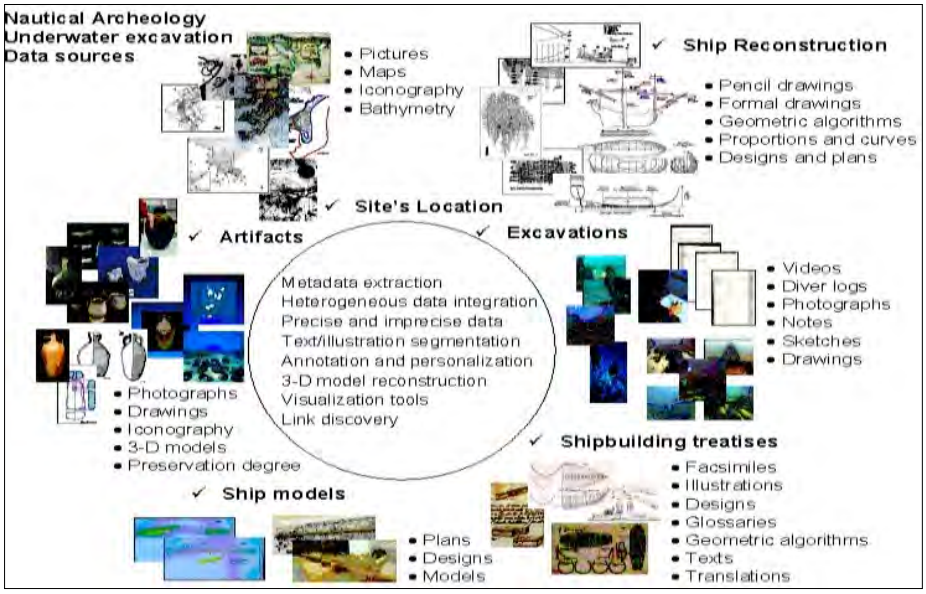
a) Developing a model for mapping an underwater archeological excavation site:

b) Establishing a protocol for storing, managing, and organizing information related to a shipwreck:

c) Creating a framework to enable the integration of heterogeneous data sources and media:

d) Developing new ways for structuring and accessing ancient shipbuilding treatises; and

e) Providing computational assistance for the identification and placement of ship fragments to allow ship reconstruction.



Publications

See pages 48-49.

Ship Ontology

Throughout the ages countless shipwrecks have left behind a rich historical and technological legacy. Nautical archaeologists study the remains of boats and ships, and the cultures that created and used them. Ship reconstruction can be seen as an *incomplete jigsaw reconstruction puzzle*. In this project Carlos Monroy hypothesized that a computational approach based on digital libraries can enhance the reconstruction of a composite object (ship) from fragmented, incomplete, and damaged pieces (timbers and ship remains).

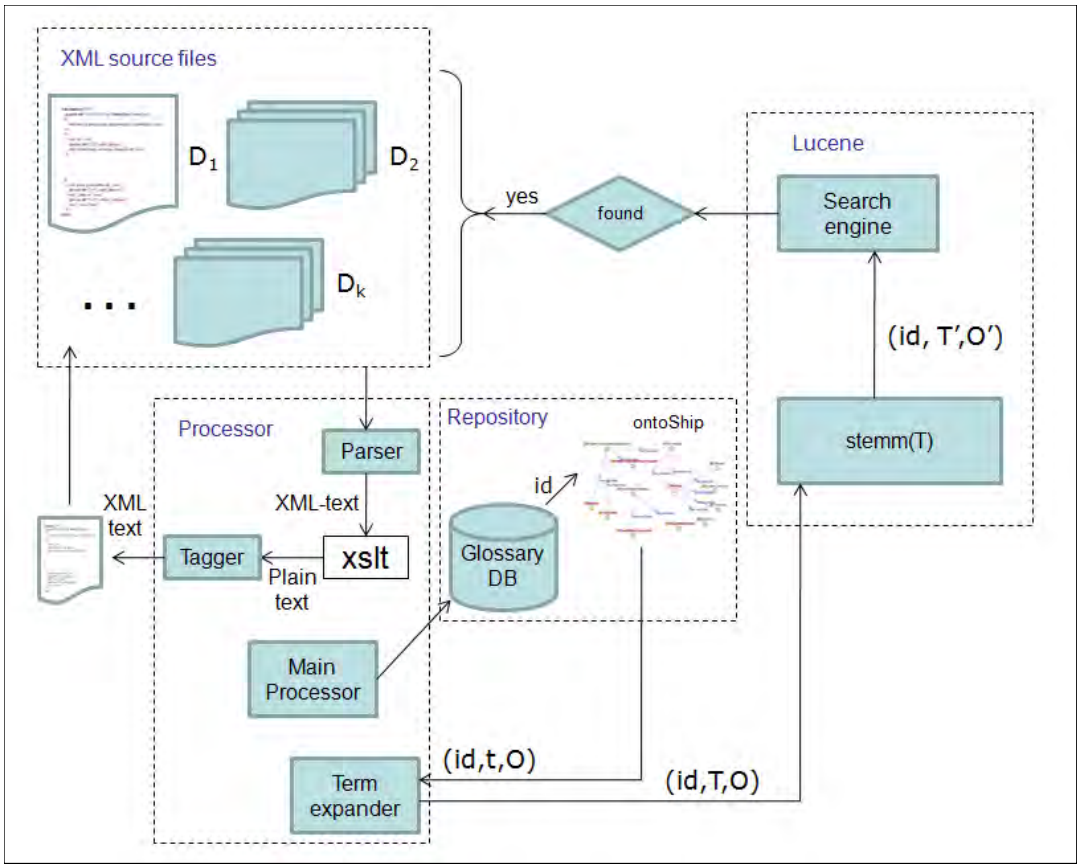


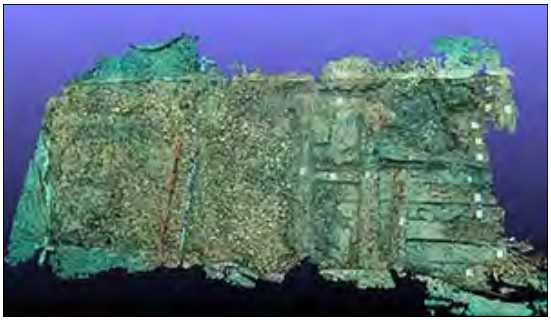
Diagram depicting the system architecture of the framework proposed in Carlos Monroy's this dissertation.

The main archaeological sources used in this project were data generated from a 17th-century Portuguese ship, the *Pepper Wreck*, complemented with information obtained from other documented and studied shipwrecks. Shipbuilding treatises spanning from the late 16th - to the 19th-centuries provided textual sources along with various illustrations. Additional visual materials came from a repository of photographs and drawings documenting numerous underwater excavations and surveys.

An ontology was developed, based on a rich database of archaeological information compiled by the late J. Richard Steffy, creator of the ShipLAB and one of the founders of the Nautical Archaeology Program. The original database was analyzed and transformed into an ontological representation in RDF-OWL **(??).** Its creation followed an iterative methodology which included numerous revisions by nautical archaeologists. Although this ontology does not pretend to be a final version, it provides a robust conceptualization.

An important component of the architecture of this project was an ontology for describing wooden ships, called *ontoShipDS*. This ontology is contained in an RDF-OWL formatted file. It was created using Protégé [Protégé 2000], an open source ontology editor.

Navigation through the ontology is possible with a web-based ontology browser. This browser is open source software provided in collaboration between the Universities of Manchester and Stanford [Ontology Browser 2009].



Photogrammetry and the Identification of Timbers

2012-

Underwater archaeology as a research discipline is a nexus between the soft and hard sciences. The problem of recording underwater sites is at the center of every project. Digging is time consuming, expensive, and a sometimes dangerous and destructive process. Archaeologists typically destroy the archaeological sites they dig; therefore accurate and comprehensive recording is the most important task of

Archaeologists must know what to measure and measure it as accurately as possible, but their responsibility does not end here. They must store and share their data with their peers, and make sure it is accessible to other scholars in the future.

Ensuring that knowledge and accuracy are the foundations of any recording process, **Pierre Drap**, a world renowned computer scientist, developed software that automatically acquires archaeological information from photogrammetric images, and creates an extremely accurate cloud of points with color metadata that represents an excavated surface chosen by the archaeologists at any given moment, .

Together with the ShipLAB and other institutions, the **Images and Models team (I&M) from the Laboratory of Sciences of Information and Systems at Marseilles (LSIS), UMR CNRS 7296**, is developing a new technology to automate the process of volume recognition. In other words, to try to automate the process from Figure 1, to Figure 2, to Figure 3. To identify the structural components of a shipwreck is not a trivial endeavor. We are developing this project along two lines of research, namely the relations between measurement/knowledge and photogrammetry/ontology, within the context of naval archaeology, where measures are often incomplete, as well as in underwater archaeology, where the aim is to develop sophisticated pattern recognition 3D/2D, which then proposes or validates typological assumptions from very precise measurements.

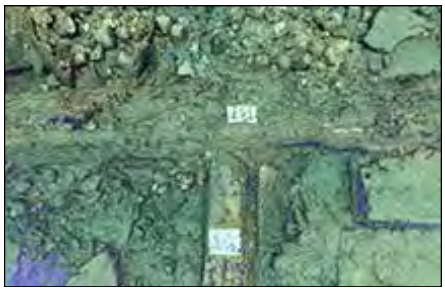


Figure 1 - Photogrammetric image of a section of a shipwreck (Gnalić, 2012).

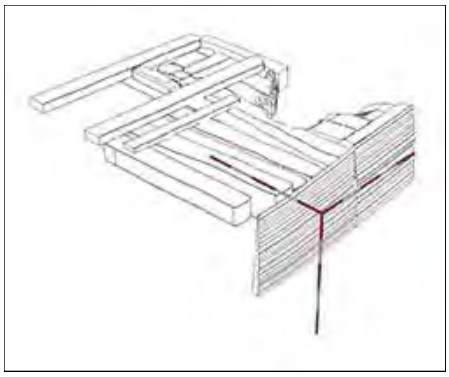


Figure 2 - Tentative reconstruction of the section recorded in Figure 1.

The survey of the current state of this shipwreck will be achieved through an automated process, departing from the recognition and localization of amphorae and other manufactured objects visible on the surface layer.

A complete and detailed ontology, already initiated at Texas A&M University, will describe the structural elements of the vessel and propose a generalization of the relation measurement/knowledge which is proposed in the context of naval archaeology.

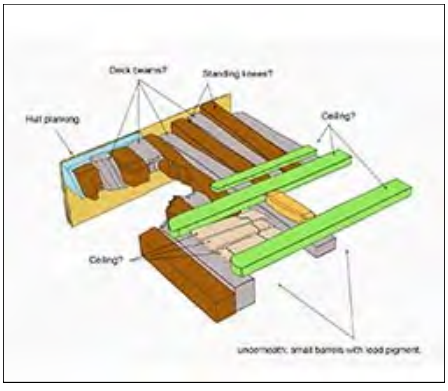


Figure 3 - Tentative identification of the timbers recorded in Figure 1.

Iberian Seafaring

Featured

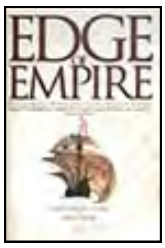
Projects

Iberian Seafaring

2001 -

Portuguese and Spanish ships of the 15th and 16th centuries were among the best in the world during this Iberian golden age. Building upon the work developed by the Institute of Nautical Archaeology in the late 1980s and early 1990s, the ShipLAB has continued to collect data and study these ships, their voyages, and the peoples that built and manned them.

Books



Castro, F. and Custer, K., eds., *Edge of Empire. Proceedings of the Symposium held at the 2006 Society for Historical Archaeology Annual Meeting, Sacramento, California*, Lisbon: Ed. Caleidoscópio, 2008.

Castro, F., *A Nau de Portugal*, Lisbon: Ed. Prefácio, 2003.

Reviews of Books

Domingues, F., Review of *A Nau de Portugal*, in *Clio, Revista do Centro de História da Universidade de Lisboa* (2004) 10: 185-190.

Neto, J., Review of *A Nau de Portugal*, in *Vega* (2004).

n/A. Review of *A Nau de Portugal*, in *Expresso* (2004).

Pereira, J., Review of *A Nau de Portugal,* blog *Abrupto* (2003).

Papers

Castro, F., "Capítulo I - Os navios dos séculos XVI a XVII: linhas gerais de evolução; unidades e medidas de arqueio" in Francisco Contente Domingues, ed., *Navios, Marinheiros e Arte de Navegar 1500-1668*, Lisbon: Academia de Marinha, 2012, 47-70.

Castro, F., "Capítulo II - Navios de vela" in Francisco Contente Domingues, ed., *Navios, Marinheiros e Arte de Navegar 1500-1668*, Lisbon: Academia de Marinha, 2012, 17-46.

Monteiro, A., Castro, F., and Génio, M., "Vida e morte do caravelão 'que andava no Castelo e trato de Arguim': autópsia de um navio dos Descobrimentos," in Matos, Artur Teodoro & Costa, João Paulo Oliveira, eds. *A Herança do Infante.* Lisboa: Câmara Municipal de Lagos/Centro de Estudos dos Povos e Culturas de Expressão Portuguesa, Universidade Católica Portuguesa/Centro de História de Além Mar, UNL/UAÇ, 2011: 209-224.

Castro, F., "O *Livro da fábrica das naus* no contexto da construção naval oceânica do século XVI" in Carlos Morais ed., *Fernando Oliveira: um humanista genial*, Aveiro: Universidade de Aveiro, 2010.

Vacas, T., Fonseca N., Santos, T., Castro, F., "The Nau from Lavanha's Manuscript", *Nautical Research Journal* (2010) 55.1: 25-36.

Vacas, T., Fonseca, N., Castro, F., Santos, T., "Reconstructing the Nau from Lavanha's Manuscript," in C. Horrel and M. Damour, eds., *Proceedings of the 2010 Annual Meeting of the Society for Historical Archaeology*, Amelia Island, Florida, 2010. Columbus, OH: ACUA, 2010: 105-113.

Vacas, T., Fonseca, N., Santos, T., and Castro, F., "A nau de dezassete rumos e meio do *Livro Primeiro de Arquitectura Naval*," in *Jornadas Técnicas de Eng. Naval* (O Sector Marítimo Português), C. Guedes Soares and C. Costa Monteiro, eds., Lisbon: Edições Salamandra, 2008: 165-182.

Carvalho, C., Fonseca, N., Castro, F., "Notas sobre a Tecnologia de Construção Naval nos Estaleiros Navais Portugueses do Século XVI," in *Jornadas Técnicas de Eng.*

Naval (O Sector Marítimo Português), C. Guedes Soares and C. Costa Monteiro, eds., Lisbon: Edições Salamandra, 2008: 207-226.

Castro, F., "Rising and Narrowing: 16th-Century Geometric Algorithms used to Design the Bottom of Ships in Portugal", *International Journal of Nautical Archaeology*, (2007) 36.1: 148-154.

Alves, F., Rodrigues, P., and Castro, F., "Aproximação arqueológica às fontes escritas da arquitectura naval portuguesa" in *Proceedings of the VI Reunião Internacional de História da Cartografia e da Náutica*, Aveiro, 1998. Cascais: Patrimónia, 2000: 225-256.

Graduate Work

Alex Hazlett, *The Nao of the Livro Nautico: Reconstructing a Sixteenth Century Indiaman from Texts* (PhD 2001-2007).

Tiago Fraga, *Santo António de Tanná: Story and Reconstruction* (MA 2002-2007).

George Schwarz, *History and Development of Caravels* (MA 2003-2008).

Blanca Rodriguez, *Standardization of Spanish Shipbuilding:Ordenanzas para la Fabrica de Navios de Guerra y Mercante - 1607, 1613, 1618*. (MA 2003-2008).

Erika Laanela, *Instrucción Náutica (1587) by Diego García de Palacio: an Early Nautical Handbook from Mexico*. (MA 2004-2008).

Bryana Dubard, *The Maritime Archaeology of Panama*. (MA 2005-2013).

José Luis Casaban, The Roconstruction of a 17th Century Spanish Silver Galleon (Ph D2010-).

Nicholas Budsberg, *15th Century Europe and the Ships of Discovery*. (PhD 2012-).

Invited Talks

Casabán, J.L. Spanish seafarers and ships' design in the early 17th century: Tome Cano's "Arte para fabricar y aparejar naos". XVI International Reunion for the History of Nautical Science. German Maritime Museum, Bremerhaven (Germany). October 2012.

Castro, F., *Caravels, Facts and Myths,* XV Reunión Internacional de Historia de la Nautica y de la Hidrografia, Ferrol, Spain, October, 2010.

Castro, F., *Os navios de Vasco da Gama,* Câmara Municipal de Lagos,Invited by the City of Lagos. April 12, 2008.

Castro, F., *Mediterranean Influence in Portuguese Shipbuilding*, 2nd Lagos Maritime Workshop. Lagos, April 2008.

Castro, F., *Iberian Ships: The Big Picture.* Summer Course - Descobrimentos Ibéricos e Arqueologia Subaquática. Câmara Municipal de Lagos / Texas A&M University / Institute of Nautical Archaeology, Lagos, Portugal, 2006.

Castro, F., *As naus da India* . Clube Militar Naval, Lisbon, Presentation of the book *A Nau de Portugal*. December 2003.

Alves, F., Rodrigues, P. and Castro, F. *Aproximação arqueológica às fontes escritas da arquitectura naval portuguesa*, VI Reunião Internacional de História da Náutica e da Cartografia, Aveiro, 1998.

Communications at International Meetings

Casabán, J. L., Castro, F., and Miguel San Claudio. *Formulas de arqueamiento y construcción naval ibérica a principios de s. XVII*, I Congreso Nacional de Arqueología Náutica y Subacuática Española, Cartagena, Spain, 14-16 March 2013.

Castro, F. *Tonnages and displacements in the 16th century*. Sixth International Congress of Maritime History, Ghent, July 2-7, 2012. Paper read by Mr. Tiago Fraga.

Fonseca, N., Castro, F., Vacas, T., and Santos, T. *Sailing Characteristics of a 16th-Century Portuguese Nau*, 42nd Annual Meeting of the Society for Historical Archaeology, Amelia Island, Florida, 2010.

Vacas, T., Fonseca, N., Santos, T. and Castro, F. *Reconstructing the Nau from Lavanha's Manuscript*, 42nd Annual Meeting of the Society for Historical Archaeology, Amelia Island, Florida, 2010.

Fonseca, N., Vacas T., Santos T., and Castro, F. *Sixteenth Century caravels in the Twenty First Century,* North East Florida Symposium on Underwater Archaeology, St. Augustine, Florida. Paper delivered by Chuck Meide. March 25-27, 2009.

Carvalho, C., Fonseca, N. and Castro, F. *Notas sobre a Tecnologia de Construção Naval nos Estaleiros Navais*

Portugueses do Século XVI, Jornadas Técnicas de Eng. Naval. O Sector Marítimo Português. Lisbon, 2008.

Vacas, T., Fonseca, N., Santos, T. and Castro, F. *A nau de dezassete rumos e meio do Livro Primeiro de Arquitectura Naval*, Jornadas Técnicas de Eng. Naval. O Sector Marítimo Português. Lisbon, 2008.

Castro, F., Nuno Fonseca, Tomás Vacas and Furio Ciciliot. *Looking at Lateen-Rigged Ships in the Mediterranean*, at the 40th Annual Meeting of the Society for Historical Archaeology Annual Conference, Albuquerque, NM, January 2008.

Newsletter Articles and Popular Publications

Castro, F., "Continuing the Work. The Group for the Study of Iberian Seafaring", *INA Quarterly*, (2006) 33.2: 3-4.

Castro, F., and Rodrigues, P., "Os canhões do galeão *Santíssimo Sacramento,*" *Mundo Náutico* (1996) 3.32: 74-77.

Castro, F., and Rodrigues, P., "O naufrágio da nau *Nossa Senhora da Atalaia do Pinheiro*," *Mundo Náutico* (1996) 3.31: 92-95.

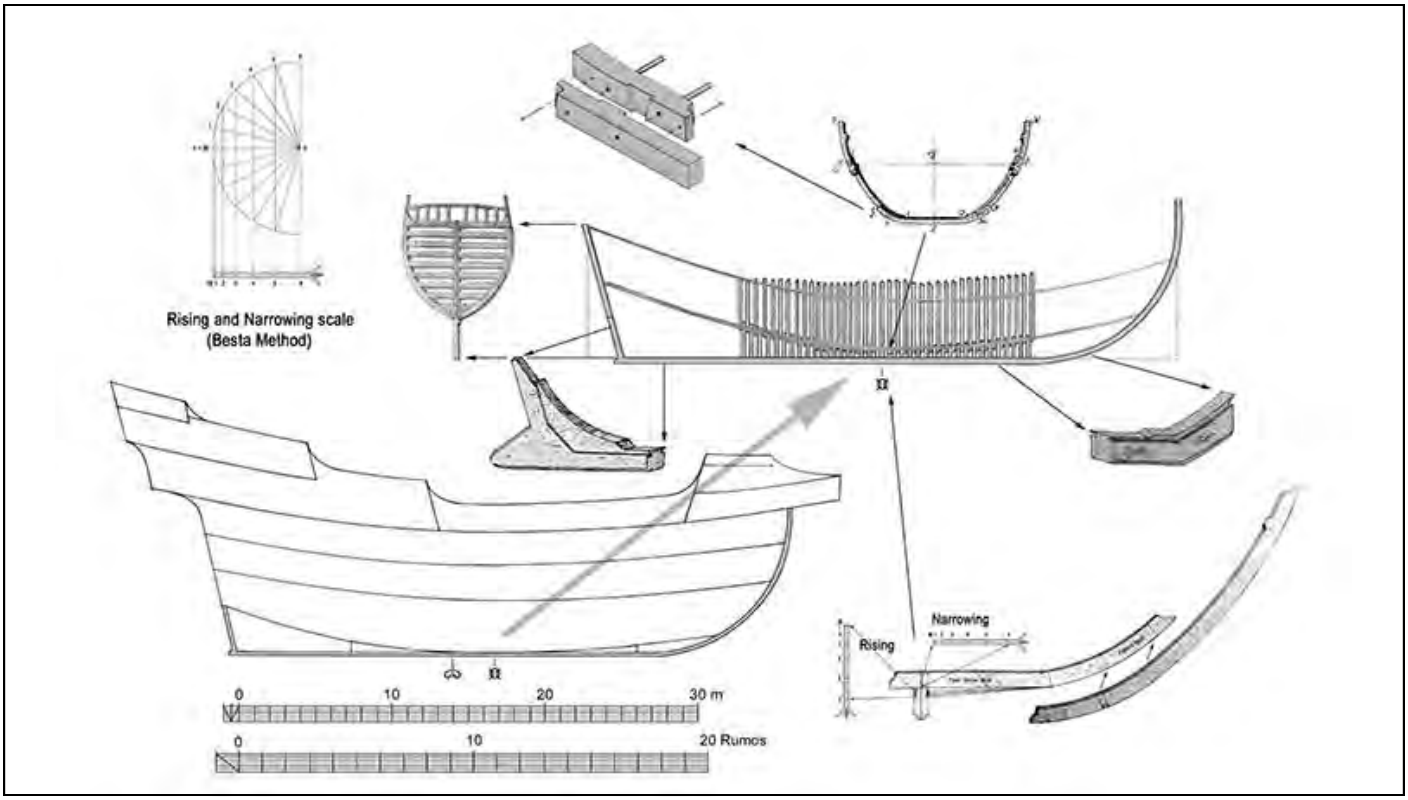
Castro, F., and Rodrigues, P., "O naufrágio da nau *S. Gonçalo* e o campo arqueológico de Plettemberg Bay," *Mundo Náutico* (1996) 3.30: 67-69.

Castro, F., and Rodrigues, P., "O naufrágio da nau *Santiago* nas Bassas da Índia em 1585," *Mundo Náutico* (1996) 3.30: 64-67.

Castro, F., and Rodrigues, P., "O naufrágio da nau *S. Bento* e o sítio arqueológico de Msikaba," *Mundo Náutico* (1996) 3.29: 68-71.

Castro, F., and Rodrigues, P., "O naufrágio do galeão *S. João* nas costas do Natal, em 1552," *Mundo Náutico* (1996) 3.29: 66-67.

Castro, F., and Rodrigues, P., "Seis naufrágios da Carreira da Índia nas costas da África do Sul - Achegas para o estudo histórico -arqueológico dos naufrágios da Carreira da Índia entre 1550 e 1650," *Mundo Náutico* (1996) 3.29: 64-65.

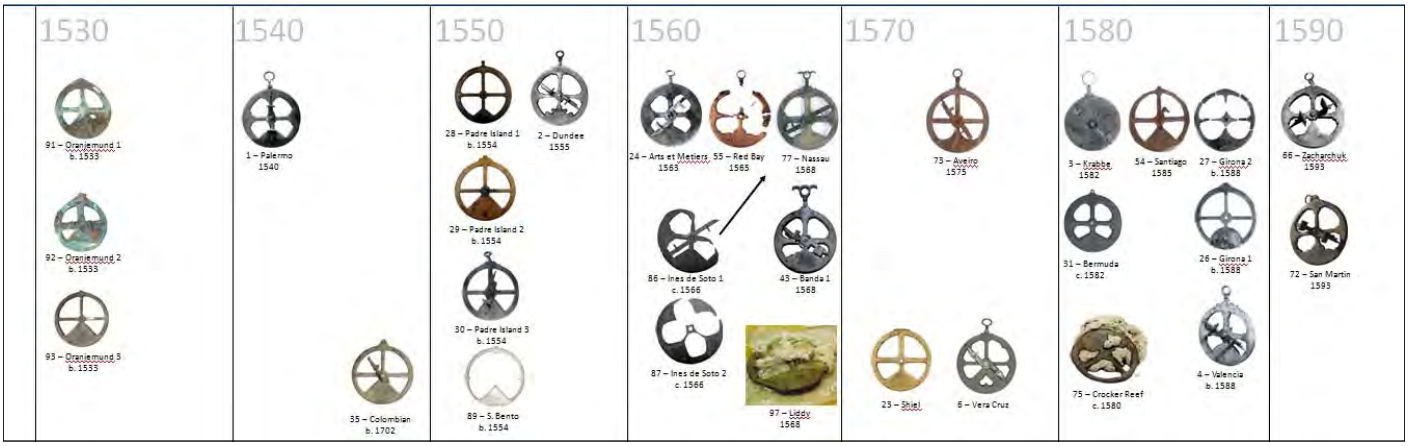


Iberian ships have some particular characteristics that seem to be regional, appearing in the Atlantic and perhaps spilling into the Baltic Sea as well (Filipe Castro).

Astrolabes Database

2005 -

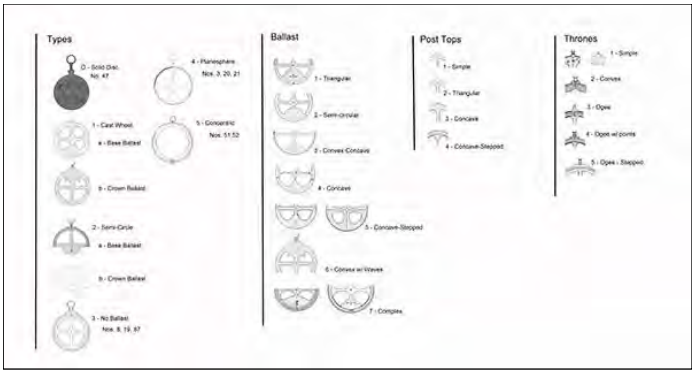
The ShipLAB is collecting information on nautical astrolabes in collaboration with Alan Stimson and as of May 2013 we have an inventory of 99 nautical astrolabes.



Astrolabes chronologically organized and sorted out according to their typologies. We have subdivided Stimson's typology to differentiate between the different kinds of ballast, post tops, and thrones (Filipe Castro).

Publications

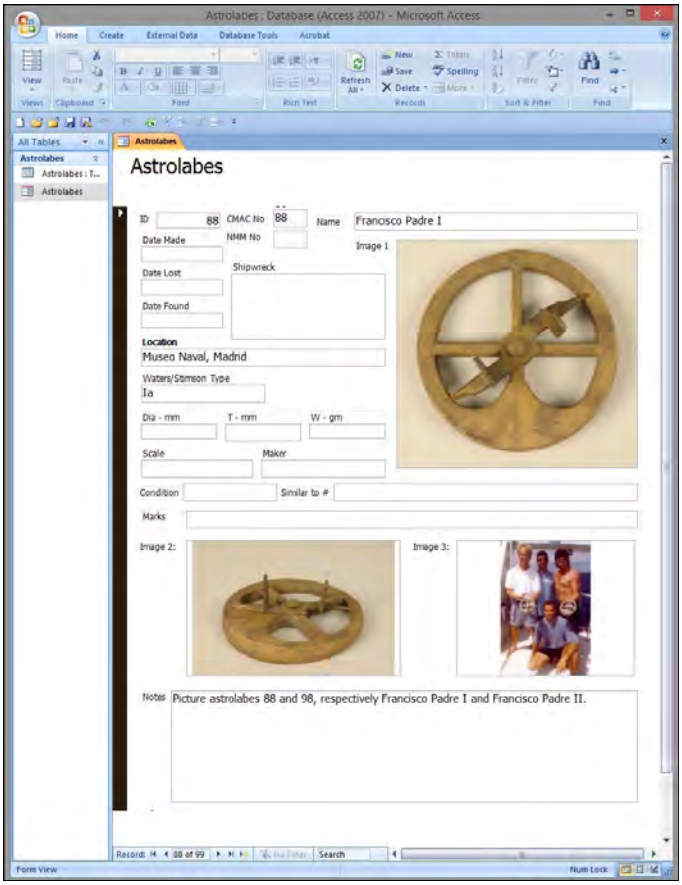
Garcia, G., "Nautical astrolabes," in Custer, K., eds., *Edge of Empire. Proceedings of the Symposium held at the 2006 Society for Historical Archaeology Annual Meeting, Sacramento, California*, Lis-



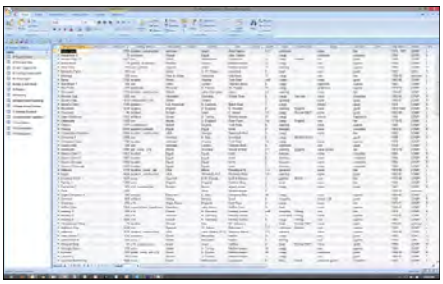
We kept Stimson's taxonomy and subdivided his types according to the decoration trends observed through time in each production center. The result is a very consistent model, which predicts the possible shapes within certain time intervals (e.g. triangular ballasts only appear between 1530 and 1570.

Graduate Work

Gustavo Garcia, *The Rincón Astrolabe Shipwreck* (MA 2000-2005).



Astrolabe database: we are still gathering data on many of the speciemen located on the internet and in auction catalogues (Filipe Castro).



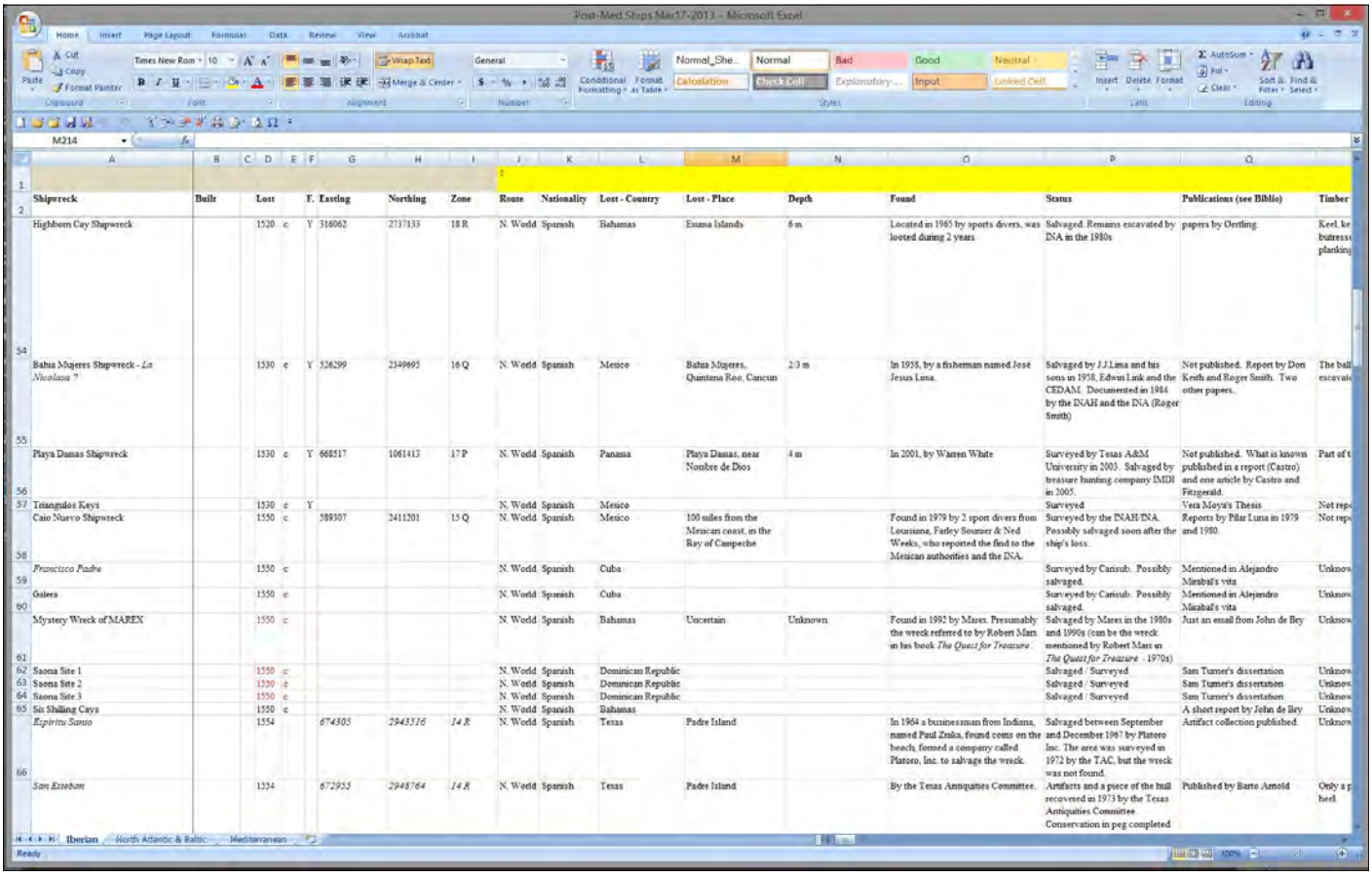
Iberian Shipwrecks Database

1998 -

At the ShipLAb we are collecting data on Iberian shipwrecks and building a database with basic information, bibliography, iconography and publications.

It is often difficult to establish dimensional relations between basic ship parts, their registered tonnage, and the sections of their structural timbers. We are interested in the variations around the relations between a ship's basic dimensions, the size of its crew, its cargo capacity, routes, and the trends observed all over Europe, while varying from place to place and through time. Ships are single artifacts produced by different maritime landscapes depending on the access to the necessary materials, taste, money, and technology available, but always in a cosmopolitan background, in which ideas travelled, adapted and evolved, crystallized, or died.

Ole Crumlin-Pedersen and Eric Rieth remind us that some construction particularities are local and parochial, and travel only small distances in centuries. On the other hand, we know that some rigging types diffused rather fast and over great distances, as for example the carvel construction, adopted all over Europe by the first quarter of the 16th century.



Shipwreck	Built	Lost	F.	Easting	Northing	Zone	Route	Nationality	Lost - Country	Lost - Place	Depth	Found	Status	Publications (see Biblio)	Timber
Highborn Cay Shipwreck		1520 c	Y	316062	2737133	18 R	N. World	Spanish	Bahamas	Exuma Islands	6 m	Located in 1965 by sports divers, was looted during 2 years	Salvaged. Remains excavated by INA in the 1980s	papers by Oertling	Keel, ke butress planking
Bahia Mujeres Shipwreck - *La Nicolasa ?*		1530 c	Y	526299	2349695	16 Q	N. World	Spanish	Mexico	Bahia Mujeres, Quintana Roo, Cancun	2/3 m	In 1958, by a fisherman named José Jesus Luna.	Salvaged by J.J.Luna and his sons in 1958, Edwin Link and the CEDAM. Documented in 1984 by the INAH and the INA (Roger Smith)	Not published. Report by Don Keith and Roger Smith. Two other papers.	The ball excavat
Playa Damas Shipwreck		1530 c	Y	668517	1061413	17 P	N. World	Spanish	Panama	Playa Damas, near Nombre de Dios	4 m	In 2001, by Warren White	Surveyed by Texas A&M University in 2003. Salvaged by treasure hunting company IMDI in 2005.	Not published. What is known published in a report (Castro) and one article by Castro and Fitzgerald.	Part of t
Triangulos Keys		1530 c	Y				N. World	Spanish	Mexico				Surveyed	Vera Moya's Thesis	Not repo
Cabo Nuevo Shipwreck		1550 c		589307	2411201	15 Q	N. World	Spanish	Mexico	100 miles from the Mexican coast, in the Bay of Campeche		Found in 1979 by 2 sport divers from Louisiana, Farley Sourner & Ned Weeks, who reported the find to the Mexican authorities and the INA.	Surveyed by the INAH/INA. Possibly salvaged soon after the ship's loss.	Reports by Pilar Luna in 1979 and 1980.	Not repo
Francisco Padre		1550 c					N. World	Spanish	Cuba				Surveyed by Carisub. Possibly salvaged.	Mentioned in Alejandro Miraball's vita	Unknow
Galera		1550 c					N. World	Spanish	Cuba				Surveyed by Carisub. Possibly salvaged.	Mentioned in Alejandro Miraball's vita	Unknow
Mystery Wreck of MAREX		1550 c					N. World	Spanish	Bahamas	Uncertain	Unknown	Found in 1992 by Marex. Presumably the wreck referred to by Robert Marx in his book *The Quest for Treasure*.	Salvaged by Marex in the 1980s and 1990s (can be the wreck mentioned by Robert Marx in *The Quest for Treasure* - 1970s)	Just an email from John de Bry	Unknow
Saona Site 1		1550 c					N. World	Spanish	Dominican Republic				Salvaged / Surveyed	Sam Turner's dissertation	Unknow
Saona Site 2		1550 c					N. World	Spanish	Dominican Republic				Salvaged / Surveyed	Sam Turner's dissertation	Unknow
Saona Site 3		1550 c					N. World	Spanish	Dominican Republic				Salvaged / Surveyed	Sam Turner's dissertation	Unknow
Six Shilling Cays		1550 c					N. World	Spanish	Bahamas					A short report by John de Bry	Unknow
Espiritu Santo		1554		*674305*	*2943516*	*14 R*	N. World	Spanish	Texas	Padre Island		In 1964 a businessman from Indiana, named Paul Znika, found coins on the beach, formed a company called Platoro, Inc. to salvage the wreck.	Salvaged between September and December 1967 by Platoro Inc. The area was surveyed in 1972 by the TAC, but the wreck was not found.	Artifact collection published.	Unknow
San Esteban		1554		*672955*	*2948764*	*14 R*	N. World	Spanish	Texas	Padre Island		By the Texas Antiquities Committee.	Artifacts and a piece of the hull recovered in 1973 by the Texas Antiquities Committee. Conservation in peg completed	Published by Barto Arnold	Only a p keel

Portion of our shipwreck spreadsheet, which presently has around 80 columns and over 200 shipwrecks.

Building upon J. Richard Steffy's shipbuilding database, we are trying to make sense of patterns and trends in the conception and construction of ships and boats, and trying to trace their spread and evolution geographically and through time. We then connect these trends and patterns with larger social and economic movements.

We are also working on a model to track the evolution and spread of shipbuilding memes. At this stage we are developing morphological matrixes and ship taxonomies to shape our research model.

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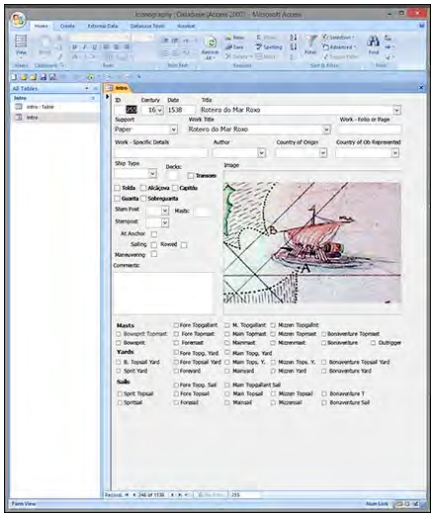
Castro, F., "The Concept of Iberian Ship," *Historical Archaeology* (2008) 42.2: 63-87.

Castro, F., "A Group for the Study of Iberian Seafaring," in Castro, F. and Custer, K., eds., *Edge of Empire. Proceedings of the Symposium held at the 2006 Society for Historical Archaeology Annual Meeting, Sacramento, California*, Lisbon: Caleidoscópio, 2008.



Iconography database developed at the ShipLAB, containing late medieval and early modern representations of ships and boats.

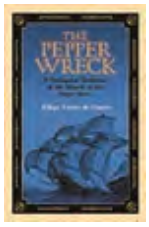
One aspect of some shipwreck positions on Google Earth.

Pepper Wreck
Portugal

1998 -

The Pepper Wreck - presumed to be the Portuguese Indiaman Nossa Senhora dos Mártires, lost in 1606 - was found on the Tagus River mouth, Lisbon, Portugal, in 1993, during an archaeological survey promoted by the Museu Nacional de Arqueologia, directed by Francisco Alves. From 1996 to 1998 it was excavated by the Instituto Português de Arqueologia / Centro Nacional de Arqueologia Náutica e Subaquática, as part of the program of the Portuguese pavilion at the 1998 world exhibition EXPO'98. In 1999 and 2000 the remains of its hull were excavated by the Centro Nacional de Arqueologia Náutica e Subaquática, with the support of the Institute of Nautical Archaeology / Texas A&M University. The study of its hull remains - which include a portion of the keel, eleven frames, and some of the planking - in cooperation with the Centre for Marine Technology and Engineering from Instituto Superior Técnico, yielded interesting results and a first glance at the largely unknown Portuguese naus da India.

Books



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Reviews of Books

Lenihan, Dan, "Nautical Soundings" review of George Bass' *Beneath the Seven Seas*, in *Archaeology Magazine* (2006) 59.3.

Loewen, B., Review of my book *The Pepper Wreck*, in *International Journal of Nautical Archaeology* (2006) 35.1: 169-171.

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Fontenoy, P., Review of *The Pepper Wreck*, in *Nautical Research Journal* (2005) 50: 122.

Special Lectures

Castro, F., *Computers and Shipwrecks: The Pepper Wreck Reconstruction as a Virtual Hypothesis*, Archaeological Institute of America J. Richard Steffy Lecture, Spokane Northwest Museum of Arts and Culture, Washington State, March 4, 2009.

Castro, F., *Computers and Shipwrecks: The Pepper Wreck Reconstruction as a Virtual Hypothesis*, Archaeological Institute of America George H. Forsyth, Jr. Lecture, University of Iowa, Iowa, October 6, 2008.

Remains of the hull exposed in 1996 (Francisco Alves).

Castro, F., *Sailing a Portuguese Indiaman*. Archaeological Institute of America Danyale Z. English Lecture. Washington DC Society. February 2007.

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Institute of America Danyale Z. English Lecture. The Archaeology Society at Staten Island. February 2007.

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Preparing to dive in the winter of 1996 (Augusto Salgado)

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Castro, F., *The Pepper Wreck:*

Raising diagnostic timbers in 1999 (Guilherme Garcia).

Rigging a Portuguese Indiaman. Archaeological Institute of America McCann and Taggart Lecture Series in Underwater Archaeology. Western Illinois Society, Monmouth College. November 2005.

Keynote Addresses and Invited Talks

Castro, F., *Arqueologia Subaquática e História da Náutica – A bordo de uma nau da India em 1600*, Faculdade de Letras da Universidade de Lisboa, April 16 2010.

Castro, F., Keynote Address. *Reconstructing an early 17th-Century Portuguese Indiaman,* at 'ArsNautica', International Symposium. Maritime Archaeology and History of the Middle Ages and the Post-Medieval Period. Dubrovnik, Croatia, 7-9 September 2009.

Castro, F., *Life Aboard a Portuguese India Nau,* Trinity University, San Antonio, TX. Invited by the Southwest Texas Archaeological Society and Trinity University. September 21, 2007.

Castro, F., *Reconstructing a Portuguese India Nau,* Trinity University, San Antonio, TX. Invited by the Southwest Texas Archaeological Society and Trinity University. September 20, 2007.

Castro, F., *Reconstructing a Portuguese India Nau,* Freer Gallery, Smithsonian Institution, Washington D.C. Invited by the Portuguese Foreign Office. August 25, 2007.

Castro, F., *A reconstrução de uma nau da Índia do inicio do século XVII*. Segundo Curso de Verão: História da Náutica, Lagos, Portugal. June 2007.

Drafting a floor timber at 1/1 scale

Castro, F., *Sailing the Pepper Wreck*. Texas A&M University Nautical Archaeology Program Shipwreck Weekend, College Station, Texas, April 2007.

Castro, F., and N. Fonseca. *A bordo da nau de SJB2, 'The Pepper Wreck'* XIII Reunión Internacional de Historia de la Nautica y de la Hidrografia. Borja, Spain, November 2006.[1]

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Castro, F., *The Pepper Wreck: Final Report.* Shipwreck Weekend, Texas A&M University, 2002.

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Castro, F., *A 17th-Century Wreck at the Mouth of the Tagus River.* Shipwreck Weekend, Texas A&M University 1999.

Castro, F., *An East Indiaman off the Lisbon Sandbar* at Brown Bag Talks, Anthropology Department, Texas A&M University, 1998.

Castro, F., *The Pepper Wreck*, Invited Lecture in the course ANTH628 - New World Seafaring, Texas A&M University, 1998.

Excavating a trench underneath a portion of the hull remains removed (Guilherme Garcia).

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Santos, T., Fonseca, N., Castro, F., and Vacas T., "Loading and Stability of a Late 16th Century Portuguese Indiamen," in *Journal of Archaeological Science* (2012) 39: 2835-2844.

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Communications at International Meetings

Castro, F., Nossa Senhora dos Mártires*, an early 17th-Century*

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Castro, F., *O aparelho de uma nau da Índia: a origem do navio de três mastros*, 4.º Congresso de Arqueologia Peninsular, Faro, Portugal, 2004.

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Sabrosa, A., *De Macau a Lisboa – Na Rota das Porcelanas Ming*. Lisbon: Instituto Cultural da REAM, 2004.

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Nau Nossa Senhora dos Mártires. Revista bimestral da Comissão Nacional para as Comemorações dos Descobrimentos Portugueses. Lisbon: Grupo de Trabalho do Ministério da Educação para as Comemorações dos Descobrimentos Portugueses, Abril/Maio 1998.

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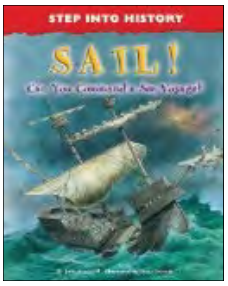

Julia Bruce and Peter Dennis, *Sail!: Can You Command a Sea Voyage?* Berkeley Heights, N.J. : Enslow Elementary, 2009

Lisbon's Naval Museum has a window dedicated to the Pepper Wreck.

Graduate Work

Sara Brigadier. *The Artifact Assemblage From the Pepper Wreck: An Early Seventeenth Century Portuguese East-Indiaman That Wrecked in the Tagus River* (MA 1998-2002 – Chair: Kevin Crisman).

Inês Coelho. *A cerâmica oriental da carreira da Índia no contexto da carga de uma nau – a presumível Nossa Senhora dos Mártires*. Lisbon: Master Thesis, Universidade Nova de Lisboa, 2008.

Newsletter Articles and Popular Publications

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Same text in English (pp. 97-98).

In the Media

Amaral, R., "Mártires do Tejo." *O Independente*, 1 August 1997, p. 49.

Belo, M., "O tesouro das Indias" *Grande Reportagem*, (March 1997) 8.72.

Arade 1 Shipwreck Portugal

2002 - 2003

First found during dredging operations in 1970, the Arade 1 shipwreck was photographed and inspected by amateur archaeologists in subsequent summers. Since there were very few artefacts, this wreck was eventually forgotten and abandoned. During the following decade the Arade 1 hull decayed, broke flat, and was covered by sediments. In the summer of 2001 Centro Nacional de Arqueologia Náutica e Subaquática (CNANS), the Portuguese agency for nautical archaeology, relocated the site and secured an agreement with the local municipality and museum for a long-term project of excavation, conservation and study of the Arade River underwater cultural heritage. In 2002 a team of students from the ShipLAB was invited to participate on the excavation of this shipwreck.

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Castro, F., "Archaeology and Dredges: the Arade River Archaeological Complex", *International Journal of Nautical Archaeology*, (2005) 34.1:72-83.

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Invited Talks

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Reports

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Further Work by Other Teams

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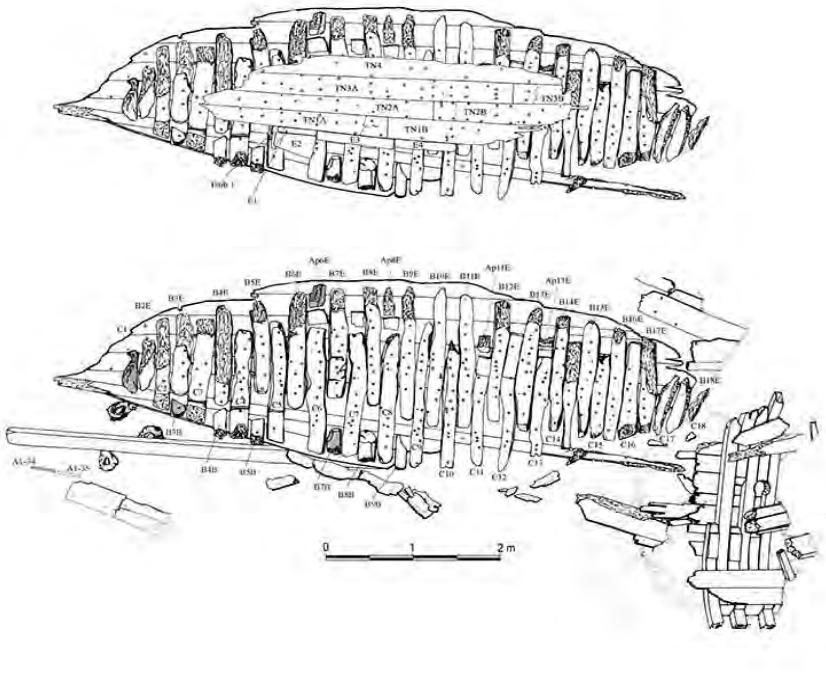
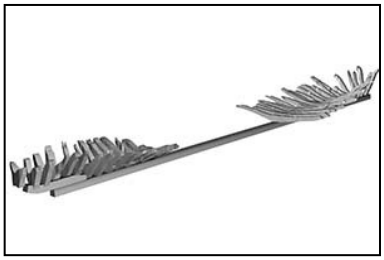
Casella, G. M., Almeida, I. M ., and Lacerda, M., *Trabalho de Investigação sobre peças de Estanho encontradas na Foz do Rio Arade (Portimão*). Paper for the course of "Introdução aos estudos de arqueologia e da história de arte" at Faculdade de Letras of the Universidade de Lisboa, teacher Luís Manuel Teixeira, 1984. On file in IPA/ CNANS' library.

Academic Work

Loureiro, V., *L'épave Arade 1 : l'influence des chantiers régionaux sur la tradition de construction navale ibér o - atlantique.* Lille: Atelier national de Reproduction de Thêses, 2012.



Arade 1 Shipwreck Site Plan after the 2002 Summer Season (Filipe Castro).



Cais do Sodré Shipwreck Portugal

2001 -

The Cais do Sodré shipwreck was found in April 1995, during the excavation works for the construction of a new subway station near downtown Lisbon, which is now the terminus of the Caravela line; named after this find. Dated to the 16th Century, these hull remains are an interesting example of a ship conceived with the whole molding method. The shape of the hull and the relation between its scantlings and its size are still a puzzle to researchers.

Publications

Castro, F., Yamafune, K., Eginton, C., and Derryberry, T., "The Cais do Sodré Shipwreck," in *International Journal of Nautical Archaeology* (2011) 40.2: 328-343.

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Reports

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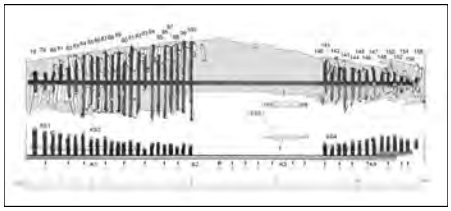
Castro, F., *Relatório dos trabalhos de registo arqueográfico das madeiras do navio do Cais do Sodré, Verão de 2001,* on file in IPA/CNANS' library, 2001.

Communications at International Meetings

Nicolardi, M. and Castro, F. *Molds and architectural signs in the skeleton first construction: a methodology to reconstruct the original hull's shape of the Cais do Sodré shipwreck*. International Symposium in Ship



Cais do Sodré Frames mounted on a straight keel (Filipe Castro).

and Boat Archaeology, Amsterdam, October 8-12, 2012.

Invited Talks

L'archeologia fluviale in Portogallo:il caso del relitto di Cais do Sodré, Convenio Internazionale "Storie di unomini e di acque," Aquileia, Italy, 24-25 February, 2012. Paper delivered by Massimo Capulli.

Castro, F., *The Cais do Sodré and Arade Projects 2002*. INA Annual Board Meeting, Dallas, January 2002.

Rodrigues, P., Alves F., Rieth E. and F. Castro. *L'épave d'un navire de la moitié du XV.ème siècle / début du XVI.ème, trouvée au Cais do Sodré (Lisbonne). Note Préliminaire*, International Symposium 'Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition', Lisbon, 1998.

Newsletter Articles

Yamafune, K., and Castro, F., "Reconstructing the Cais do Sodré Ship," *CMAC News and Reports*, (2010) 2.2: 20-22.

Cape Finisterre Project Spain

2011 -

Since 2011 the ShipLAB is cooperating with Spanish archaeologist Miguel San Claudio in several projects in Galicia, aiming at inventorying, studying and publishing the region's impressive underwater cultural heritage. We are also collaborating on several research topics related to the Spanish maritime world of the 16th and 17th centuries, when Spain built and sailed some of the best ships in the world.

Cape Finisterre extends from the Iberian mainland into the North Atlantic and lies along one of the most important maritime routes in the region. With its rocky coastline and reefs, brutal winter storms, dangerous currents, and dense fogs this dangerous coastline is known in Spain as *La Costa de la Muerte* (Coast of Death) and has become the final resting place for many ships, along with their passengers and crew.

One of the worst maritime disasters to occur in this area took place on the night of October 28, 1596, when a storm took an armed Spanish fleet by surprise off Cape Finisterre.

In the last decades of the 20th century the remains of what seemed to be one of the 1596 shipwrecks were discovered by seafood harvesters at Punta Restelos. In 2007, looting of this shipwreck was detected and communicated to the authorities. The Regional Government of Galicia supported a preliminary archaeological survey of the Punta Restelos shipwreck to document the archaeological remains. The survey was conducted by the Spanish archaeologist Miguel San Claudio and his Cultural Resource Management (CRM) firm Archeonauta S.L. During the surveys, six more shipwrecks, which are thought to be part of the fleet of 1596, were located together with shipwrecks from later periods.

Communications at International Meetings

San Claudio, M., Castro F., Gonzalez, R., Casabán, J.L. El pecio de Ribadeo, un excepcionalmente bien conservado pecio español del siglo XVI. I Congreso de Arqueología Náutica y Subacuática Española. ARQVA – Museo Nacional de Arqueologia Subacuatica. Cartagena (España). Marzo 2013.

Casabán, J.L., San Claudio, M., Castro F., Gonzalez, R. Pecio de Punta Restelos. I Congreso de Arqueología Náutica y Subacuática Española. ARQVA – Museo Nacional de Arqueologia Subacuatica (España). Marzo 2013.

San Claudio, M., Castro, F., Gonzalez, R., Casabán, J.L. La gestión del patrimonio cultural sumergido en Galicia, el caso del SS Great Liverpool. I Congreso de Arqueología Náutica y Subacuática Española. ARQVA – Museo Nacional de Arqueologia Subacuatica. Cartagena (España). Marzo 2013.

Folgueira, M.V. La conservación de metales procedentes de los pecios del Proyecto Galicia. I Congreso de Arqueología Náutica y Subacuática Española. ARQVA – Museo Nacional de Arqueologia Subacuatica (España). Marzo 2013.

Newsletter Articles

Casaban, J., San Claudo, M., Castro, F., González, R., "The Finisterre Project: the Punta Restelos Shipwreck," in *INA Annual 2013*.

Casaban, J., San Claudio, M., and Castro, F., "The Finisterre Project," *INA Quarterly* (2012) 39.3/4: 21.

Casaban, J., San Claudio, M., and Castro, F., "Finisterre Project: Shipwrecks from Death's Coast," *CMAC News and Reports* (2011) 3.2:15-16.

Nicholas Budsberg

Renaissance and the Ships of Discovery

2011-

The Iberian discoveries are part of the Renaissance cultural revolution, and its ships and boats cannot be studied outside this context. Connected by the sea, during the 15th and 16th centuries the world as seen by the Europeans never stopped growing. Although the ships of exploration do not seem to have gathered much attention from the intellectual elites until later in the 16th century, it is likely that the desire for learning and discovering that framed this period impacted their conception and construction.

The economic advantages of the newly opened maritime trade routes were obvious. Although sailing around the African continent was a long an dangerous endeavor, a small ship with 150 tons of capacity could carry the cargo of 1500 camels and stay away from most thieves, warlords, tolls and taxes.

During these two centuries the conception and construction of ocean-going ships evolved and blended along the Atlantic coasts of the Iberian Peninsula, a region situated on the nexus of two diverse seafaring worlds: the Mediterranean and the North Atlantic and Baltic.

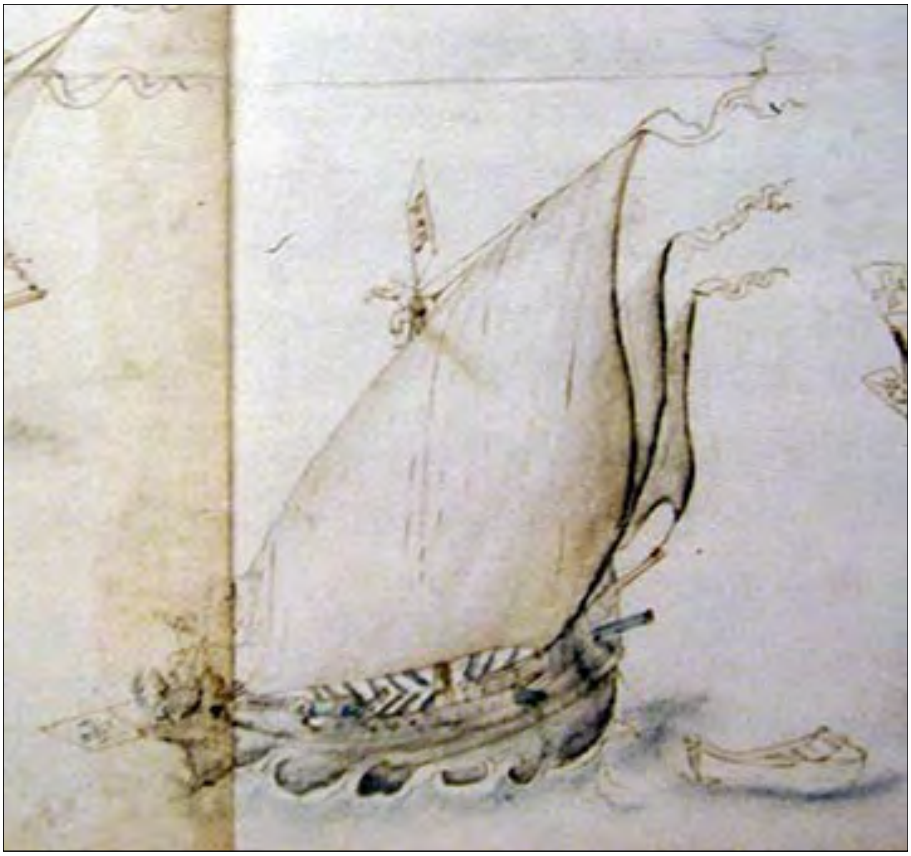
It is said that the keel of one of Amerigo Vespucci's ships hang from the ceiling of Lisbon Cathedral—together with other curiosities from the Portuguese discoveries—until the earthquake of 1755.

What emerged from this 'Atlantic Tradition' was a flush-laid, skeleton-built, two or three-masted vessel that paired new arrangements of square and lateen sails for its rig. Construction details and phases, or transitions in development, are still largely unknown, and the answers to these questions and others can only be found through archaeological research.

This project proposes to gather and research the available archaeological data pertaining to 15th and early 16th century ships and interpret and evaluate it in the context of the cultural, economic and political history of Europe.

Modern nautical archaeology has contributed much to Iberian maritime studies since the field's inception in the 1960's. Initial research into early European shipwrecks in the New World began in the 1980's and continued into the 1990's with students from Texas A&M, although historical research into this time period dates back to the late 19th century with the coming 400th anniversary of 1492. The public's interest with Christopher Columbus,

Above: 15th century cog graffiti on the walls of Batalha monastery, Portugal.



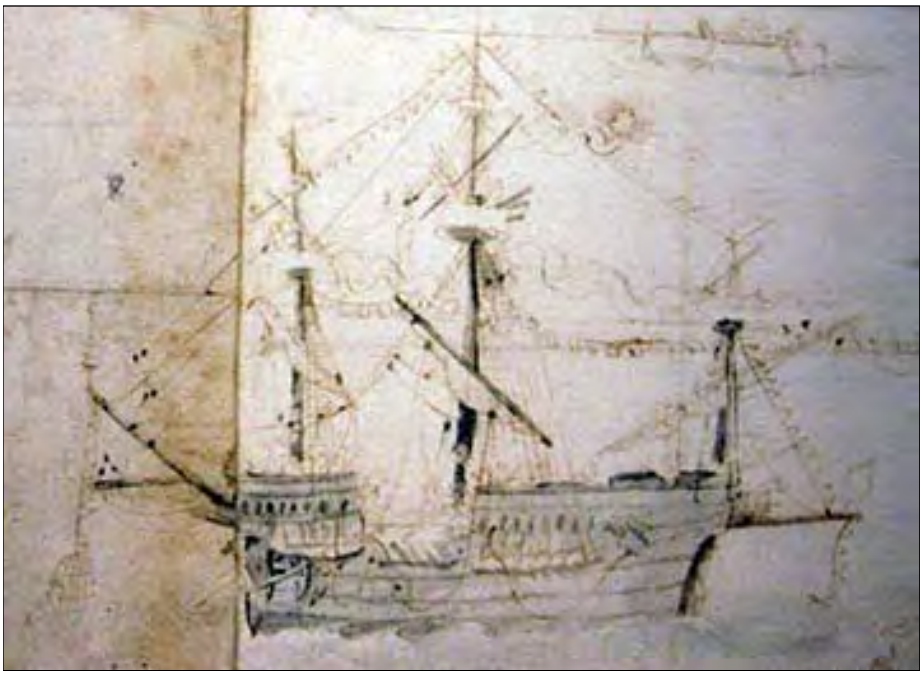
Armed lateen caravel in the Leiden view of Lisbon, dated to the 1530s.

the *Nina, Pinta,* and the *Santa Maria*, and other contemporary explorers and their ships has not dwindled over the years, as many recent studies and reconstructions have been done regarding these vessels and others, although not enough is known about the caravels and naos of the exploration period to accurately reproduce one.

This dissertation will focus on the shipwrecks that are currently known but have yet to be thoroughly investigated. In the New World the Highbourne Cay wreck has been partially excavatd, the Bahia Mujeres shipwreck surveyed, and the Playa Damas shipwreck salvaged. Only one early 16th century shipwreck has been excavated so far – the Molasses Reef wreck in the Turks and Caicos – and the timber remains were scarce and partially destroyed by treasure hunters before the excavation. In Europe a handful of shipwrecks from this period has been excavated but not entirely published.

We intend to inventory the information available and try to make sense of it in the context of the history of the Renaissance, as these were among most complex objects built in their time. Their study will teach us about our technological history and ingenuity, and will help us understand the first step in the history of globalization.

Remains of a 15th century ship found in Lisbon at Largo do Corpo Santo (Kevin Gnadinger).



Navio in the Leiden view of Lisbon, dated to the 1530s.

Traditional Shipbuilding Techniques at Baía de Todos os Santos, Brazil

2011 -

Step by step procedures for calculations of a ships' basic dimensions and shapes are known throughout the Mediterranean, and can be found in historical documents found along most of the northern coast of the Mediterranean, in the Iberian Peninsula, and in the New World. These solutions are generally referred to as "whole molding" and consist of the utilization of a small number of molds and ribbands to obtain – or repeat – a particular shape of a ship's hull with a reasonable accuracy. Before the development of lines drawings and lofting methods, the ability to repeat a certain hull shape was paramount to shippers and shipwrights. To build "by eye" did not provide any guarantee of precision, even to the most skilled shipwrights.

Swift, agile, elegant with their bright sails and colorful hulls, the *saveiros* were the blood that supplied Baía de Todos os Santos and distributed its manufactured goods throughout the cities and villages surrounding the industrial center. Sugar, manioc, pottery, coconuts, palm oil and spices were transported raw and processed, to and from the city of Bahia, since times long forgotten.

Anthropologist Pedro Agostinho

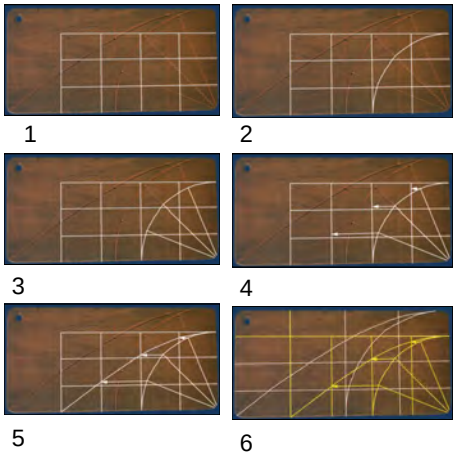
(2011) made the case for the evolution of the colonial caravels through "the slower rhythm of cultural change, [which] may have preserved until today many archaic structures, forms and techniques." His seminal work was later re-edited with a set of magnificent images and established a history and a typology of these vessels.

Another brilliant scholar, John Patrick Sarsfield, traced a hypothetical evolutionary line that explains the introduction of the present gaff sails through Dutch influence and the name change from *caravela* or *caravelão* to *saveiro*. In the 1980s Sarsfield brought these boats to Anglo-Saxon attention with three papers, and eventually had a "caravel" built by one of the shipwrights that used a version of the whole molding method.

Communications at International Meetings

Castro, F. and Dias, D. G. *Graminhos and the Transmission of Knowledge in Portuguese Shipyards during the Early Modern Age*. XVIth International Reunion for the History of Nautical Science. Bremerhaven, 3-6 October, 2012.

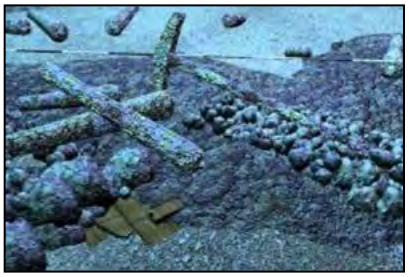
Gomes, D., *Os segredos da arte. Um olhar etnolinguístico sobre os carpinteiros navais do Baixo Sul da Bahia*. Bahia: UEFS Editora, 2009.



Traçado do graminho do mestre João Bezerra, Segundo Lev Smarcevski (1996).

Dias, D. G. "Memories from the sea: linguistic and ethnographic sources for Bahia´s nautical history." *XVth International Reunion for the History of Nautical Science*. Ferrol,4-6 November, 2010.

Dias, D. G. "No que viajam sobre a água: remanescentes da cultura náutica brasileira documentada em relatos de viagem do século XVI**."** *Do Brasil a Macau: narrativas de viagem e espaços de diáspora*. Lisboa, 10 a 14 de setembro, 2008**.**



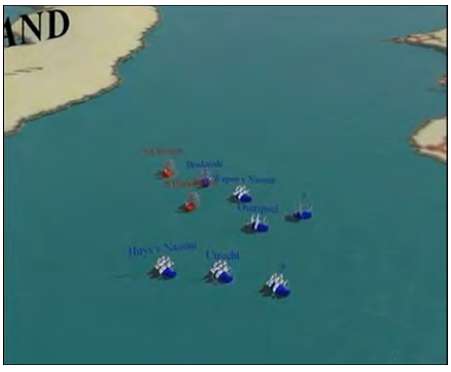
Battle of Itaparica

Brazil

2011 -

The Utrecht *shipwreck site lies at a depth of 21 meters on a flat sandy bottom, 5 nautical miles (9.3 km) from Itaparica Island and 10.1 nautical miles (18.7 km) from the city of Salvador, northeastern Brazil. It sunk in 1648, together with the Portuguese ship* Nossa Senhora do Rosário, *in the battle that would later be known as the battle of Itaparica.*

The Dutch ship *Utrecht* sunk off Itaparica Island, in the waters of the state of Bahia, northeast Brazil, after an engagement with the Portuguese vessels *Nossa Senhora do Rosário* (32 guns) and *São Bartolomeu* (32 guns) in the later period of the Dutch West India Company presence in Brazil. Incorporated in 1621, the West India Company was inspired by the success of the East India Company (1602-1798) and aimed at supporting the Dutch colonization and related commercial activities, which included privateering actions, in the Atlantic and Pacific Oceans.



Youtube animation recreating the battle of Itaparica (Kotaro Yamafune).

In Brazil, the Company's business developed around sugar production and a highly profitable slave trade. The Dutch occupation of northeast Brazil lasted from 1624 to 1654 and constitutes a rich period for the investigation of early modern geopolitics in the Atlantic.

Measuring one of Utrecht's anchors (Photo R. Torres).

On September 28, 1648, a Dutch fleet of seven sails under the command of Admiral Witte Corneliszoon de With was patrolling an area off All Saints Bay, Salvador, Bahia, when it encountered two Portuguese sails coming in from the sea, around noon. The Portuguese ships were *Nossa Senhora do Rosário* and São *Bartolomeu*, whose mission was to patrol the entrance of the bay. During the battle that followed the ships *Utrecht* (32 guns) and *Nossa Nenhora do Rosário* (32 guns) sunk. Their remains lie on the seabed, roughly 200 meters apart, at a depth of 18 to 20 meters, and have been heavily looted, although the archaeological information contained in their *tumuli* justifies further research.

Reports

Torres, R., and Castro, F., *The Utrecht Research Effort*, Typed Report on File in the Ship Reconstruction Laboratory, Texas A&M University, 2012.

Youtube Videos

http://www.youtube.com/watch?v=kCyFIRhOu4g

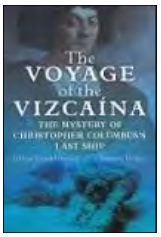
http://www.youtube.com/watch?v=3Tj6utJzbGs

Playa Damas Shipwreck Panama

2003 - 2005

Found by sport divers in the 1990s, this shipwreck was mistakenly identified as Columbus' Vizcaína*, a small 50 ton caravel lost near Nombre de Dios during his fourth voyage in 1503. In July 2003 Texas A&M University was invited to consider the complete excavation of the shipwreck at Playa Damas, located near Nombre de Dios, on the Atlantic coast of Panama. Unfortunately, this shipwreck was salvaged by a for-profit company between 2004 and 2006.*

About our Work



Brinkbäumer, K. and Clemens H., *The Voyage of the Vizcaína*, New York: Harcourt, Inc., 2006.

Brinkbäumer, K. and Clemens H., "Die letze Reise des Columbus (I)", in *Der Spiegel,* No. 25, 14.Jun.2004.

Brinkbäumer, K. and Clemens H., "Die letze Reise des Columbus (II)", in *Der Spiegel*, No. 26, 21.Jun.2004.

Invited Talks

The Shipwreck of Playa Damas: Treasure Hunters and Archaeologists, Flagler College, North East Florida Symposium on Underwater Archaeology, St. Augustine, Florida. March 20-22, 2007.

The Playa Damas Shipwreck, IIIs Jornadas de Universitárias de Arqueología Subacuática, Universidad de Huelva, Huelva, Spain. Invited by the University of Huelva. 27 to 30 November 2006.

The Playa Damas Project. INA Annual Board Meeting, Dallas, February 2005.

The Playa Damas Project, Deutsche Gesellschtaft zur Förderung der Unterwasserarchäologie DEGUWA, Berlin, Invited by DEGUWA. Paper deliveredby Dr. Donny Hamilton. February 25-27, 2005.

The Playa Damas Project. Shipwreck Weekend, Texas A&M University, College Station, March 2004.

The Playa Damas Project. INA Annual Board Meeting, Dallas, January 2004.

Publications

Castro, F., and C. Fitzgerald "The Playa Damas Shipwreck, an early 16th-Century Shipwreck in Panama," in Robert Grenier, David Nutley and Ian Cochran, *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, Heritage at Risk - Special Edition, Paris: UNESCO, 2006: 38-41.

Reports

Castro, F., 2005, *Playa Damas Project – Artifact Inventory – ShipLab Report 9*.On file in Nautical Archaeological Program Library, Texas A&M University.

Castro, F., *Playa Damas Project – Preliminary Report* submitted to the Institute of Nautical Archaeology Archaeological Committee, 2004.

Documentaries

Spiegel TV - *Kolumbus' letzte Reise*

Popular Publications

Castro, F., "O navio de Playa Damas." *Mundo Submerso* (2004) 7.88: 48-53.

Italian Seafaring

Featured

Projects

Italian Seafaring

2004 -

After the collapse of the Roman Empire and following the barbaric invasions, the political unity of the Italian Peninsula was fragmented. Reunification was not achieved until 1870, after the Third Civil War and the conquest of Rome. In this context the study of Italian Seafaring during the Middle Ages and the following periods must count with a complex and contingent historical reality, in which the local ship-building traditions were enriched by external influences, such as Arab and Byzantine, originating in a different cultural diversity in each geographical area. As Braudel pointed out, Italy has always been the middle axis of the Mediterranean, and always divided between an Italy that is turned to the West, and another that looks to de Levant. With the advent of the 12th century the Italian Peninsula witnessed a diverse and prolongedphenomenon: its maritime cities developed autonomously and expanded their interests throughout the Mediterranean and beyond. The objective of this theme is the study of the Italian ships and the contribution that its shipwrights brought to the development of shipbuilding.

Papers

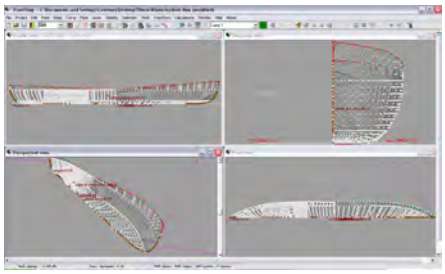
Castro, F., Fonseca, N., Vacas, T., and Ciciliot, F., "A Quantitative Look at Mediterranean Lateen- and Square-Rigged Ships (Part I)," *International Journal of Nautical Archaeology* (2008) 37.2: 347-359.

Fonseca, N., Vacas, T., e Castro, F., "Análise das características náuticas de embarcações latinas medievais", in *Actas das X Jornadas Técnicas de Eng. Naval (Inovação e Desenvolvimento nas Actividades Marítimas),* C. Guedes Soares and V. Gonçalves de Brito, eds., Lisboa: Edições Salamandra, 2006: 586-604.

Communications at International Meetings

Castro, F., and Bondioli, M. *Design Philosophy and Structure Philosophy in Shipbuilding: Invisible Signs and Visible Traces*, at the 41st Annual Meeting of the Society for Historical Archaeology Annual Conference, Toronto, Canada, January 2009.

Graduate Work



Modeling a Flanders Galley (Courtney Higgins).

Sarah Kampbell, *The Pantano Longarini Shipwreck: A Reanalysis* (MA 2004-2007).

Vincent Valenti, *Transitions in Medieval Mediterranean Shipbuilding: A Reconstruction of the Nave Quadra of the Michael of Rhodes Manuscript*. (MA 2005-2009).

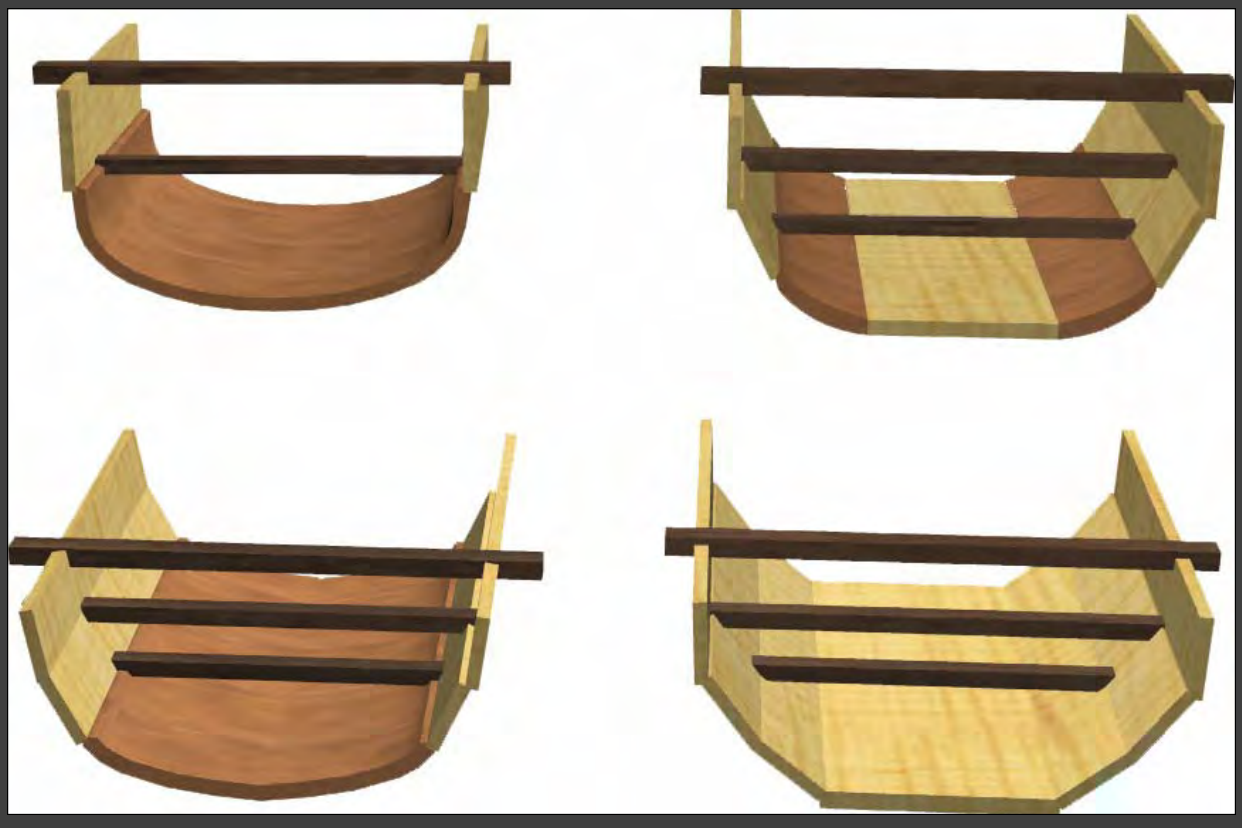
Courtney Higgins, *Venetian Galleys* (MA 2005-2012).

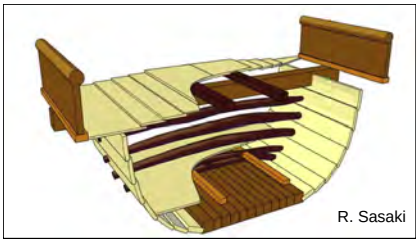
Lilia Campana, *Vettor Fausto (1490-1546), Professor of Greek and a Naval Architect: a New Light on the 16th-Century Manuscript Misure di Vascelli etc. di…Proto dell'Arsenale di Venetia* (MA 2006-2010).

Asian Seafaring

Featured

Projects





Asian Seafaring

2002 -

From the beginning of the Tang dynasty to the end of the Ming dynasty (618-1644 C.E.) China ruled the South China Sea and was the world's greatest maritime empire. As a center of maritime trade China connected the East Asian continent with large portions of the Pacific and Indian Oceans. The study of the diversity, quality, and evolution of its ships and boats is a growing subfield of maritime archaeology and the ShipLAB is participating in its development.

Graduate Work

Kotaro Yamafune, *The Portuguese Century in Japan and the Namban Screens*. (MA 2009-2012).

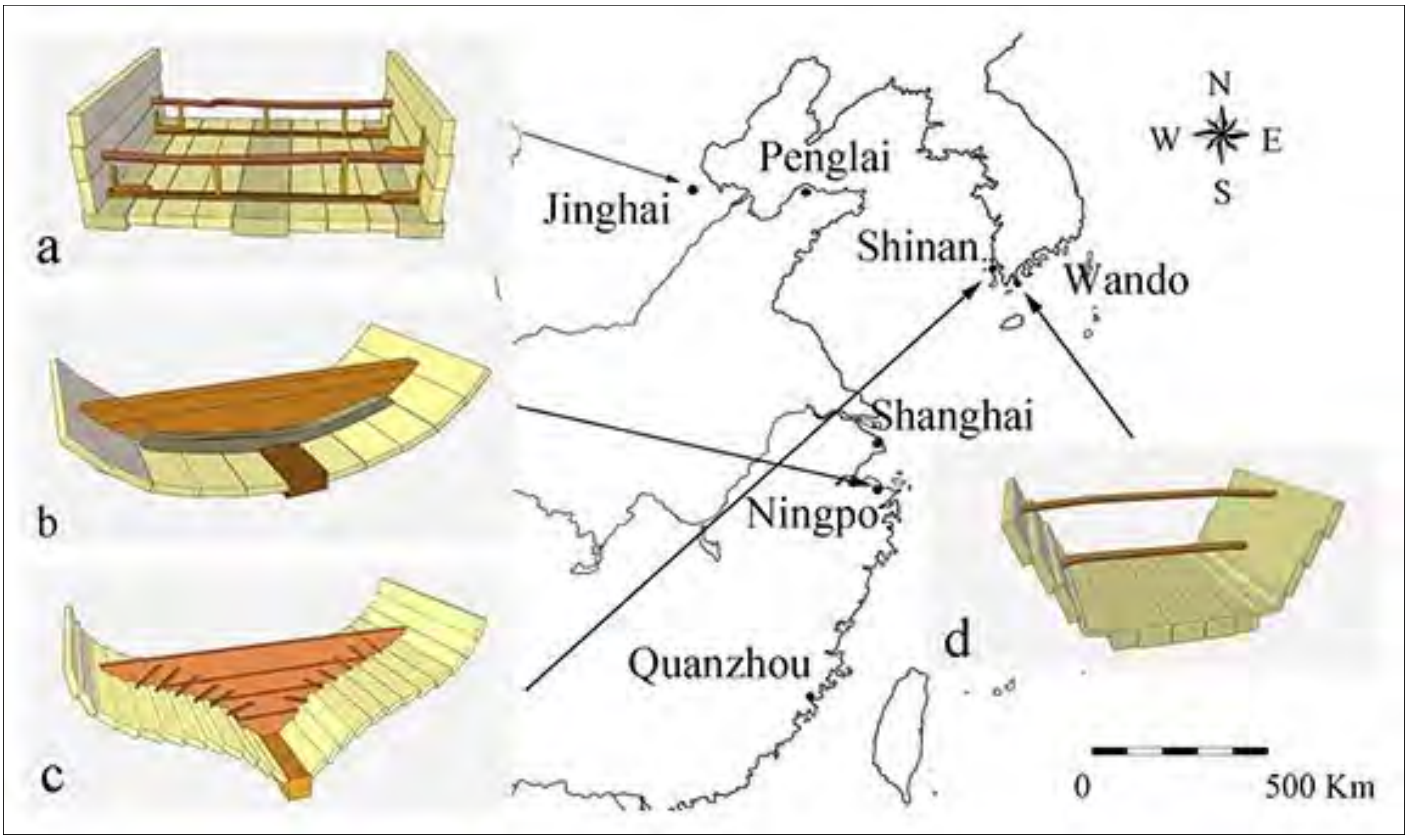
Hiroaki Miyashita, *Ancient Ships of Japan* (MA 2004-2006).

Randall Sasaki, *The Origin of the Lost Fleet of the Mongol Empire* (MA 2002-2008).

Timothy Kane, *Influence and Evolution: The Development of the Batten Lug Sail*. (MA2002-2006).

Randall Sasaki *The Origin of the Lost Fleet of the Mongol Empire*. (MA 2002-2008)

Randall Sasaki, Research at the Battle of Bach Dang River, Vietnam (PhD 2008-).



From Randall Sasaki's thesis: Asian shipwreck types. a. Flat bottom, b. round bottom, c. v-shaped, and d. traditional Korean type.

Randal Sasaki

Research at the Battle of Bach Dang River, Vietnam (1288)

2008-

Looking at a history of any particular nation, there will always be a few historically significant events that shaped the ethos of the nation and its people. One such event, for Vietnamese history, is the battle of Bach Dang River fought in 1288 C.E.

In this battle the country of Dai Viet (today's Northern Vietnam) successfully defended the nation from the invading Mongol Empire. It is said that the Vietnamese set up a trap by planting numerous wooden stakes along the Bach Dang River and waited for the enemy's fleet to arrive. By luring the enemy to the field of stakes at the changing of the tide, Vietnamese were able to immobilize the fleet and successfully crush the invading enemy. In the 1950s and 1960s, a large number of wooden stakes were discovered at the town of Yen Hung in Quang Ninh Province (location believed to be the battle site) and Vietnamese archaeologists determined that the stakes were indeed from the battle of Bach Dang River.

However, no artifacts from the battle - other than the wooden stakes - were found. In fact, there are still numerous questioned to be answered. Did the battle really took place at the site? Where did the ships disappear? What was the main battle strategies and why were the stakes placed where they are? In 2008, initiated by Randall Sasaki, a member of the Institute of Nautical Archaeology, the Maritime Archaeology Program at Flinders University, and the Institute of Archaeology at Hanoi created an international research team to answer these questions. A series of surveys and excavations have been conducted, supported by various organizations including the National Geographic Society.

Excavation conducted by Vietnamese Archaeologists.

Despite the fact that no shipwreck has been located as of yet, the project revealed many aspects of the Vietnamese battle strategies and led to the discovery of new "stake-fields" which are now registered as national historic sites. The project has gained national attention in Vietnam, initiating other nautical and underwater archaeology related projects in the country.

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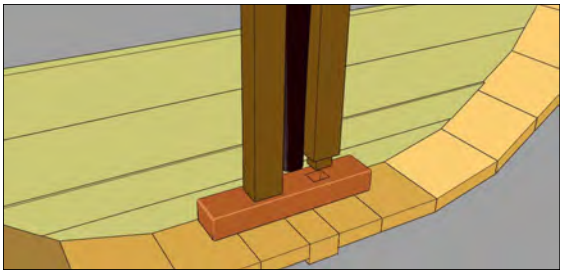

Randal Sasaki

Kublai Kahn Lost Fleet

2002-2008

In 1279 C.E., under the rule of Kublai Khan, the Mongols sent a fleet of more than 4000 vessels to subjugate the island nation of Japan, when a powerful typhoon crushed the invading fleet into pieces. The great wind, called kamikaze, or divine wind, thus saved the nation from foreign rule.

Historical sources suggest there were three main types of vessels involved in this event: V-shaped cargo ships for transporting provisions to the front, constructed in the Fukien province in China; miscellaneous flat and rounded bottom vessels made in various areas along the Yangtze River; and flat bottomed landing crafts from Korea.

An illustration of a vessel in *Mōko Shūrai Ekotoba* Scroll.

In the recent past the remains of the fleet were discovered at the Takashima underwater site in western Japan, unveiling numerous artifacts including weaponries, ship board items, and hul sections . The site consists of the ship remains built in China and Korea. The interpretation of the artifacts is thus extremely complex. In order to determine the origin of the vessels, a logical framework was necessary. The author created a timber category database, analyzed joineries, and studied the philosophy of shipbuilding to ascertain the origin and types of vessels.

Excavated Timbers kept at Takashima Board of Education.

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Kotaro Yamafune

Namban Screens

2009-2012

Namban screens are a well-known Japanese art form that was produced between the end of the 16th century and throughout the 17th century. More than 90 of these screens survive today. They possess substantial historical value because they display scenes of the first European activities in Japan. Among the subjects depicted on Namban screens, some of the most intriguing include ships: the European ships of the Age of Discovery.

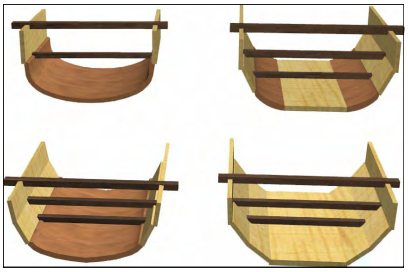
Namban screens were created by skillful Japanese traditional painters who had the utmost respect for detail, and yet the European ships they depicted are often strangely anachronistic .

On maps of the Age of Discovery, the author discovered representations of ships that are remarkably similar to the ships represented on the Namban screens. Considering the hypothesis that ships of some of the Namban screens are copies of ships represented on contemporary European cartography,

Late 17th or early 18th century Portuguese ship according to one of the artists. Version C of Museu Nacional de Arte Antiga, Lisbon.

the author realized that one particular historical event connecting Europe and Japan may be the source of these representations. This event was the first visit of the Japanese Christian embassy, the Tensho Embassy, to Rome, in 1582. Its journey to Europe and its following visit to the *Taiko*, or first effective leader of Japan, Hideyoshi Toyotomi, may have been a trigger for the production of one of the most well-known Japanese artworks, the Namban screens.

Namban Screen: Version A of Kyushu National Museum (left panel).



Hiroaki Myiashita

Ancient Ships of Japan

2004-2006

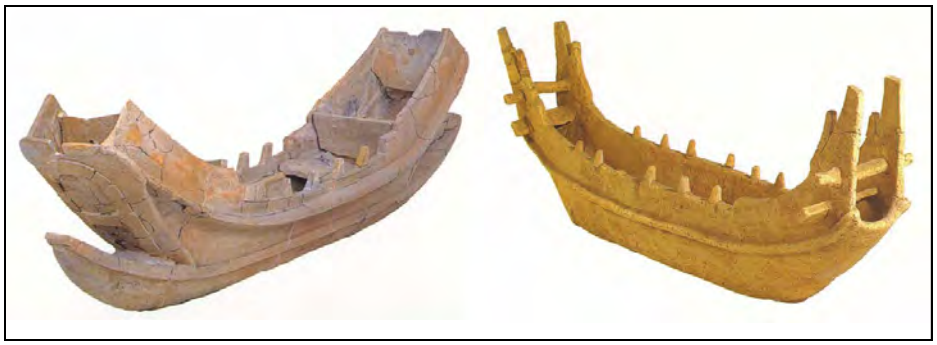
Ancient ships of Japan are little known outside of the country. They were the object of this study, presented based on the studies of past researchers, together with a comprehensive analysis of their archaeological remains. The process of development from logboats to extended logboats and finally to assembled craft was traced. This study covered evidence from the Early Jomon period (4000 – 3000 B.C.E.) through the Kofun period (300 – 700 C.E.). A large number of logboat remains date to the Jomon period, and it is these logboats which become the foundation of later Japanese ships. The number of ship remains from the Yayoi period diminishes. Therefore, iconographic evidence, mainly clay ship figures and drawings, was used in order to reconstruct the ships from that time.

Japan is an island country from where it is impossible to cross over to the continent without ships. This has been taken for granted and therefore, until the mid-twentieth century, little attention has been focused on ships and their history.

However, the concern with nautical history has been growing, and a considerable number of studies have been conducted on this subject, and have brought about substantial results.

Logboats have been broadly used since the prehistoric times and are generally the same from Europe to China. The earliest example of a logboat was found near Pesse in the Netherlands, and dated to about 6300 B.C.E.

Although it seems that most complex ships developed from logboats, the process of development from the primitive stage to a more sophisticated form is different in different areas. Ships in Northern Europe or in the Mediterranean developed first into shell-first or plank-built ships, then to skeleton-first or frame-first ships. Meanwhile, ships in China seem to have developed from logboats to extended logboats, and after that to junks, which were characterized by their structural bulkheads.



Split-hulled and single-hulled figures. (From Adachi 1998, 16)

Ships in Japan developed differently from those in other countries. Abundant archaeological evidence has been found from ancient times, unlike the medieval period (1167 – 1568 C.E.) and later, for which there is no evidence as yet. Studies of ancientships in Japan have been earnestly undertaken by Japanese archaeologists, historians, and folklorists since the second quarter of the twentieth century. The development process of Japanese ships has been roughly explained.

It is generally said that ships in Japan evolved in the following order: logboat, extended logboat and assembled craft. In this project a typology of the early Japanese watercraft was presented, based on both archaeological and ethnographic evidence.

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